

**A TASTE FOR CONSUMPTION:
Food Waste Generation in
New Zealand Cafés and Restaurants**

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ABSTRACT

Globally, approximately one-third (1.3 billion tons) of all food produced for human consumption each year ends up wasted throughout the food supply chain. This food waste has social, environmental and economic impacts which have been well documented. In developed countries, such as New Zealand, food waste primarily occurs during ‘consumption’, involving retail, domestic, and foodservice settings.

Foodservices are estimated to waste up to 20% of all food entering their operations, but little is known about food waste within the growing café and restaurant sector.

Food waste generation in a randomised representative sample of New Zealand cafés and restaurants was investigated using a mixed methods approach. A convenience sample was later instigated in response to low participation rates from the randomised sample during data collection, within the first component of this research. The second data collection component of this research involved a sub-sample of participants recruited solely from convenience sample responders. Data collection techniques involved self-reported questionnaires during the first component (n=13, 5.2% of representative sample; n=18, 26.5% of convenience sample), researcher-measured 24-hour audits during the second component (n=11, 16% of convenience sample) and informal conversations during both components. International best-practice techniques were used to quantify and classify food waste, to identify where in the system waste occurs, and to explore staff perceptions regarding food waste generation and reduction opportunities.

Most cafés and restaurants (21 of 29) reported food waste as less than 20% of total business waste. Audited food waste found most businesses (7 of 11) generated around

4kg-10kg daily, with a high proportion considered avoidable. Nearly all had quantified avoidable food waste proportions of more than 50%, while every business self-reported the amount of avoidable food waste they generated as being less than their corresponding audit quantified amount. Customer plate waste and food preparation waste were the dominant food waste streams, with vegetables, accompaniments and lower-value carbohydrates featuring highly among commonly wasted food types cited. Food waste generation was generally perceived as minimal and businesses were comfortable with how much food waste they generated. Most businesses identified both financial (30 of 31) and environmental (23 of 31) outcomes as important motivators for reducing food waste.

These findings indicate that New Zealand cafés and restaurants generate a significant amount of food waste. The magnitude, location and causes of food waste must be understood, and a targeted action plan established. Accordingly, businesses should utilise the ‘United Nations Sustainable Development Goal Target 12.3 strategy’ steps (i.e. Target, Measure, and Act) to reduce food waste. Reduction initiatives may be most effective if they tap into financial and environmental motives, and consider customer behaviours driving plate waste.

PREFACE

This individual Master's thesis was carried out through the University of Otago as one part of an overall two-part research project which aimed to establish nationally representative baseline data regarding food waste generation by the New Zealand Café and Restaurant sector. Collaborative work was carried out with a fellow Master of Dietetics candidate to achieve an approximately equal split of the national café and restaurant distribution based on geographic location. This thesis will report on the results generated from all of New Zealand excluding the Upper North Island regions (Auckland, Northland and Waikato/King Country/Thames Valley).

Joint academic supervision was kindly provided by Dr Miranda Miroso, from the Department of Food Science, and Dr Louise Mainvil, from the Department of Human Nutrition, for both Master's theses. The initial thesis concept was proposed by Dr Miranda Miroso, and after collaboration between both supervisors and Master of Dietetics candidates, the amended final thesis concept was accepted by the Dietetic candidate. This thesis contains work from September 2016 to November 2017.

Additionally, this thesis could not have been written without the existing research conducted, and guidelines established, by other authors, for whom I have provided references for, to the best of my ability.

As a Master of Dietetics candidate, I was responsible for the following:

- Literature search
- Joint development of ethics and consent forms prior to submission
- Joint adaptation of existing research and guidelines to develop data collection tools and research methodology

- Randomised and convenience sample participant selection and recruitment
- Data collection - conducting questionnaires, on-site food waste audits and conversations with participants
- Data collation and analysis
- Thesis writing and project time-management

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‘He aha te mea nui o te ao?

He tangata, he tangata, he tangata.’

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LIST OF ABBREVIATIONS

FSC	Food Supply Chain
SDG	Sustainable Development Goals

1.0 INTRODUCTION

Food loss and waste is becoming an increasingly important global issue as the social, environmental and economic impacts are recognised and understood in more depth (1-5). On a global scale, it is estimated one-third (1.3 billion tons) of all food produced each year for human consumption, is lost or wasted across the food supply chain (FSC) (1, 2, 4). Social costs of food waste are simultaneously evident in the worldwide implications of both malnutrition and food insecurity, and obesity (6-8). Wasted food incurs environmental costs via the loss of natural resources utilised to produce the food, plus, the ecological effects of preventable landfill carbon dioxide emissions (1, 2, 4). Furthermore, the sheer scale of food that is wasted creates hefty economic consequences, amounting to global financial losses of \$940 billion annually (1, 5). Accordingly, food waste cannot be ignored or down-played, and a widespread global effort is required to address this important issue.

In developed countries, such as New Zealand, food waste primarily occurs later in the FSC, within retail and consumption (2, 7, 9). Consumption wastage alone averages 40% of all food waste in these nations (4). Such is the significance of this issue, one of the 17 United Nations Development Programme (UNDP) sustainable development goals (SDG) addresses global food loss and waste. Launched in early 2016, 'SDG12' aims to achieve and embed sustainable consumption and production practices, including the specific target of halving the global per capita food waste of retail and consumption stages by 2030 (1, 10, 11). This target is important for increasing food production and supply efficiency, while also aiding both food security and development of a more resource efficient economy (1, 10).

Accordingly, the foodservice industry has the potential to make significant reductions in food waste, because an estimated 20% of all food acquired by the industry ends up in waste bins (12). This diverse and complex industry has many different sectors (13), including the café and restaurant sector. International food waste research within this sector is growing (14-19), however, it lacks a consistent methodological approach and universally accepted measures for quantifying food waste generation (13).

There is a gap in New Zealand-specific research detailing café and restaurant food waste generation and where it occurs. Given the significant growth occurring in the New Zealand café and restaurant hospitality sector (20, 21), the potential contribution of this sector to the issue of food waste, both nationally and globally, should not be ignored. However, with such minimal understanding of current café and restaurant food waste generation, the ability to understand and manage food waste quantities, and the associated implications, is limited.

This research begins to address this knowledge gap by establishing baseline estimates of daily food waste quantities and waste reduction practices in New Zealand cafés and restaurants (Section 3.0). Both self-report and observational methods will be used to quantify total and avoidable food waste and to identify where food waste is arising and what food types are commonly wasted. Furthermore, drivers of food waste generation and reduction will be explored from the perspective of café and restaurant staff (Section 5.0). Lastly, participant findings will inform recommendations for future research related to reducing café and restaurant food waste (Section 6.0).

2.0 LITERATURE REVIEW

There is a growing consensus that food waste is rapidly becoming an increasingly important issue (2, 3, 6, 9, 11, 22-25) as demand for food is expected to increase significantly in line with the increasing, and more affluent, world population (2, 4, 7, 15, 26). It has been reported that approximately 30% to 50% of all globally produced food for humans is not eaten (4, 5, 10, 27-29), but is wasted for various reasons. The accuracy of this shocking figure has been questioned, due to the contributing data being outdated and no longer applicable (30), and the lack of a consistent universal measurement for food waste (2, 13, 15, 31) variously reported by weight, caloric value, energy (resources) lost, economic volume or per capita. However, concern about food waste shouldn't be ignored given the current health issues faced by many world-wide.

Clear distinctions are evident between population groups across the world. Between 795-925 million people are estimated to be food insecure and undernourished (6-8, 10, 28), in which they lack access to adequate, safe and nutritious food for normal growth, development and well-being (8), while around one billion people are classified obese with an over-abundance of food availability and consumption (6, 7, 10, 27, 28). These paradoxical social problems combined with the negative impacts of environmental degradation resulting from the use (and consequent waste) of resources to produce all this wasted food (2, 4, 7, 9, 15, 23, 24, 26, 32, 33), form strong ethical foundations for the need to understand and act to significantly reduce global food waste.

This chapter will explore the current literature regarding food waste, focusing on the hospitality foodservice industry. It will begin by outlining why food waste is an important issue, how food waste is defined and related terms (1.1), and current food

waste knowledge within the broad foodservice industry (1.2). Next, it will focus on the hospitality foodservice (1.3), outline the nature of food waste generation specific to this sector (1.4), and the resulting implications of hospitality food waste (1.5). It will then cover the basis for food waste analysis and best practice recommendations (1.6), and explore social and cultural contexts that influence sector food waste generation (1.7). Lastly, two important theoretical frameworks relevant to the sector will be discussed (1.8) before concluding with a brief chapter summary (1.9).

2.1 Defining food waste

Food waste is commonly described as any food originally intended for humans to consume that remains uneaten, ending in non-food outcomes such as ploughed-in crops, anaerobic digestion, compost, incineration or disposal to landfill, sewer or sea (2, 4, 7, 23, 24, 31, 34, 35). However, literature differences occur over the inclusion of edible food intended for animal consumption (22), and over-nutrition, where average energy consumption exceeds average energy needs on a per capita basis (36).

The term food supply chain (FSC) describes the linked series of activities undertaken from producing raw food material to final food consumption (23, 25, 31). The term food waste can apply to all FSC stages from farmer to end consumer (7, 15, 23, 24), or as distinguished from the wider concept of food loss (production, postharvest, processing) to apply only to food waste created during FSC end stages (retail, consumer consumption) because of human behaviour (2, 4, 11, 30, 32, 37). Waste generated during these end stages incurs a greater negative effect than earlier in the FSC, as food products accumulate additional costs and resource input during preparation before consumption (2, 10, 12, 15, 24).

In this present research, the term food waste applies to the latter FSC, as the consumption stage encompasses businesses (2, 3, 11), and therefore, the hospitality foodservice industry which includes cafés and restaurants. Additionally, food waste in developed countries, such as New Zealand, primarily occurs during FSC end stages (2, 7, 9, 37), with consumption averaging over 40% of total food waste in these nations (4).

2.1.1 Types of food waste

To understand and measure the issue of food waste it is essential to distinguish preventable food waste from that which isn't. The literature frequently does this by employing the terms 'avoidable' and 'unavoidable', occasionally including 'potentially avoidable' as further differentiation (6, 18, 23, 33). Avoidable food waste is any food suitable for humans to eat at some point within the FSC, but ends up discarded or disposed of, even if inedible by this time (2, 6, 15, 18, 23, 24, 33). Product and hygiene regulations, quality specifications, technological processes, and eating behaviours are identified as reasons this may occur (24).

Unavoidable food waste is deemed to be food parts (by-products) never intended for humans to eat and considered inedible, such as meat bones, banana skin, egg shells, fruit cores, coffee grounds and slaughter waste (2, 6, 15, 18, 23, 24, 33). Additionally, potentially avoidable food waste is used to reclassify food that may be eaten in some situations but considered inedible in other situations (6, 15, 23, 33). Examples include fruit and vegetable skins, bread crusts, animal organs, seeds and peels. Furthermore, these situations and definitions are subjective due to the way they are influenced by culture, religion and social practices (15).

A recent FUSIONS food waste quantification manual (13) re-orientates the above definitions by employing categories for differentiation as (a) both food and associated

inedible parts, (b) only food, and (c) only associated inedible parts. These categories can be loosely aligned with the terms potentially avoidable, avoidable and unavoidable respectively.

2.2 Food waste knowledge in the foodservice sector

To date, food waste-related studies have been undertaken to explore different aspects of food waste, and within different foodservice settings. These settings include hospitals, school canteens, university foodservices, airline catering, domestic households and supermarkets (12, 38-44).

Specific to the café and restaurant setting, multiple international studies have been undertaken that address various aspects of food waste arising within this sector (12, 14-19, 33, 35). However, these papers lack a consistent approach regarding methodology and food waste quantification measure and are not necessarily applicable to the café and restaurant sector in New Zealand.

2.3 Hospitality foodservice: cafés & restaurants

While international literature varies in the scope used to define this sector, a broad theme emerges for any hospitality and foodservice operators undertaking the preparation, provision and serving of food as a core business activity to be included, regardless of public or private, non-profit or profit status (6, 15, 18, 24). Frequently, literature reports only a broad definition of hospitality foodservice within the study scope, simply stating the type of establishment recruited, e.g. hotels, restaurants and for-profit caterers such as workplace cafeterias (6, 35). Moreover, significant overlap often occurs within the definitions used to establish industry subsectors (13).

New Zealand Government organisations use a generic definition whereby cafés and restaurants are units primarily concerned with providing and serving food and drinks on-site for customers to purchase, generally providing table service with payment made after eating (45, 46). Specific notes detailing exclusions accompany this definition.

2.4 Food waste in hospitality foodservice

A multitude of terms appear in the literature to differentiate areas where food waste occurs, seemingly influenced by the nature of the hospitality business. For example, the terms ‘spoilage’ (unusable contaminated or expired food), ‘preparation’ (meal preparation and cooking methods) and ‘plate waste’ (food uneaten by consumer) are commonly used for non-buffet-style restaurants (17, 19), whereas buffet-style restaurants must account for ‘leftover buffet waste’ (prepared but not chosen by customer) (24, 33). Other identified terms defining food waste areas in restaurants, using slightly different parameters, include ‘over-production’, ‘plate leftovers’ and ‘kitchen waste’ (34).

Additionally, a Spanish study (15) coined previously unreported terms, from a business perspective, to determine who generates the food waste, and its level of importance, as perceived by the foodservice manager. This approach describes two areas, ‘pre-consumer waste’ (all food waste generated prior to food placed on customer plates) and ‘post-consumer waste’ (uneaten food left by customer), where pre-consumer waste is considered relevant to Profit & Loss statements, which consequently tends to be minimised. Post-consumer waste, however, tends to be regarded as having no financial impact on the foodservice (15).

Due to variance for classifying and measuring food waste, there is no universal agreement as to how much food waste the hospitality sector generates. A Swiss study

that analysed foodservice data from two studies cautiously estimated food waste as 18% of total food input by caloric value, with three quarters (13.5%) considered avoidable (23). Using a kg/per person/per capita value, the same study calculated a weighted total of 20%, with over half (12%) considered avoidable (23).

A British study of hospitality foodservice sub-sectors reported food waste generated by restaurants and quick service restaurants equated to 23% and 8% respectively of total food purchased by weight, most of which is avoidable (17). Allocating total kitchen food waste to the generation area found 45% was preparation, 34% was customer plate waste and 21% was spoilage (17). Another British study of ten commercial restaurants reported higher preparation waste at 65%, similar plate waste at 30% and minimal spoilage waste at 5%. Total food waste was reported as averaging 480g per customer (19). Furthermore, a Malaysian restaurant case study (33) found 56% of total food waste and 92% of customer plate waste was considered avoidable. A considerably higher average for daily food waste per customer (1.1kg) was found, although this may be a consequence of the buffet-style service. Additionally, food waste may still be under-quantified as drink and liquid food waste is often excluded from the study scope.

The different data values discussed above highlights that different methodologies and study scope can influence results and make comparisons difficult. It is therefore timely that the FUSIONS manual (13) provides a recommended methodology, designed for European Union State Members, to begin efficiently quantifying food waste across the entire FSC, including practical guidelines specific to the foodservice sector. Included is the recommendation that food waste data should be quantified in 'weight-based' values. To further enhance consistency, four streams of foodservice food waste generation have been detailed, influenced by the destination of each food product. These streams can be generalised in simple terms as transport and storage, on-site food preparation, unserved

prepared food, and consumer plate waste. On critical reflection, the realm of the food preparation stream can be argued to encompass both on-site food preparation and unserved prepared food, as both have involved food preparation activities, but have not been purchased by customers. In this sense, these FUSIONS streams loosely equate with the terms food spoilage, food preparation and customer plate waste.

2.4.1 The New Zealand context

The Better Restaurant and Café Guide (47) briefly outlines the need to reduce food waste, as well as associated benefits, as food waste accounts for 50% of all waste by weight generated by a typical café/restaurant. However, it is specific to the Auckland area and focuses on food waste disposal rather than reducing food waste generation.

The Hospitality Report (2013) (48), while not explicitly mentioning food waste, refers to the growing trend, both locally and internationally, of the increasing importance of environmentally sustainable food practices.

2.5 Implications of hospitality food waste

There is little research, especially qualitative, on food waste causes and patterns in hospitality settings, which may be due to the complex nature of food waste generation. Significant hospitality industry growth, both overseas and in New Zealand, means that food waste generation, especially avoidable waste, is an important issue gaining attention (4, 14, 20, 21). Charelbois et al (14) asserts attention should be given to understanding how foodservice practices such as kitchen management, procurement and menu design, impact on food waste occurrence.

However, most hospitality businesses generally reduce food waste in accordance with economic criteria. Consequently, only ‘visible’ food waste with a financial impact is considered important (15), acting to maintain low awareness of total food waste. Derqui

et al (15) argue that if foodservice operations view plate waste as determined solely by the customer, there is a tendency for plate waste to go unmeasured and, as it has been paid for by the customer, be disregarded as impacting on financial performance.

Accordingly, strategies to reduce hospitality food waste should also increase awareness of environmental and social impacts of businesses food waste, consequently increasing total food waste visibility. This assertion aligns nicely with the increasingly popular 'Triple Bottom Line' (49) accounting framework which provides a way for environmental and social issues to be considered. This framework enables businesses to measure performance against three focus areas, Profits, People and the Planet (3 P's), rather than solely focused on financial performance and outcomes. Accordingly, this weaves sustainability concepts into business practice which undoubtedly has an important role in maximising successful food waste reduction.

The type of food served significantly influences food waste levels, so food types (e.g. fruits, vegetables, bread, dairy) should be identified separately in relation to exploring food waste patterns and causes (15, 50). It is also logical that a foodservices' use of convenience or pre-prepared foods (e.g. pre-peeled pumpkin cubes) will impact on both food waste generated on-site (e.g. less preparation waste), and economic performance (e.g. increased food costs). Additionally, rigid product specifications (e.g. for fresh produce) that result in below-standard, but still edible, products being wasted instead of used as intended (15), is an area that would also benefit from further research.

Other reported business-related food waste implications include pressure to maintain a large menu range, increased portion sizes (more food increases likelihood customers won't finish their meal) and unpredictable external influences affecting customer numbers. Thus, the difficulty increases for balancing inventory, demand and food preparation to limit food waste (2, 14, 15, 51). However, FUSIONS determines

foodservice food waste is linked to storage and equipment issues, technology, and not following good practice (13). Appropriate practices identified as potential strategies for businesses to minimise food waste include optimal product storage, avoiding excess stock, staff training, fast food cooling, flexible portion sizes (reduced portions), attractive presentation, allowing more than one helping, and exposing consumers to food waste issues and encouraging feedback (9, 14, 24, 52). Derqui et al also cite an existing concept that consumer education may be particularly relevant for hospitality foodservice as consumers tend to place less value on food not prepared by themselves, family or friends (15).

2.6 Food waste analysis

The fundamental basis of food waste analysis is that to fully understand the scope, location and size of the problem, food waste needs to be measured, and targets set, to accurately gauge where to implement reduction initiatives and quantify their efficacy and impact (3, 4, 11, 13). This is demonstrated by the widely cited quote attributed to Peter Drucker (53), ‘what gets measured gets improved’.

Food waste analysis methods, detailed in the literature range from questionnaires, focus groups and diary records, to mass balance, electronic information systems, observations and food waste sample audits (3, 16-18, 33, 42, 43). However, in response to the absence of a consistent and coherent universal approach for measuring and quantifying food waste, FUSIONS recently published a manual outlining recommended approaches for different FSC sectors (13). Within foodservice, the significant variety of operator characteristics is acknowledged within the recommended approach for obtaining new food waste data. Multiple key methods are outlined to encourage consistency and accommodate foodservice diversity, along with guidance for when each method is

appropriate. Outlined approaches for new data are based on direct weighing (for waste streams with or without non-food waste materials), counting and/or scanning, and diary-based methods (13). Additionally, pros and cons of each are listed.

2.7 Social and cultural contexts influencing food waste

Social, cultural and religious beliefs and practices have a profound impact on food production, demand and consumption, as well as food waste generation (7, 9, 22, 30, 33). The way the FSC functions (economically, environmentally and socially) will be influenced by these beliefs, and consequently our thoughts and actions influence food waste generation too. For hospitality foodservice, it is argued that food consumption and food waste generation shouldn't be separated, as both need to be examined alongside each other to fully understand 'how, where and why' food waste occurs (33).

In developed countries like New Zealand, the sharing and consumption of food is a significant social and cultural activity (7, 48). Our background beliefs inform our food consumption behaviour, including our expectations of the way our food is stored, prepared and presented, and the amount of plate waste we leave behind in cafés and restaurants. Hospitality foodservice staff use their perceptions and beliefs to influence their food purchasing, preparation and serving practices (9, 22). For example, Lipinski et al (2013) (2) notes that restaurants use increased meal and portion sizes to attract customers, implying food purchases are good value for money. However, this can encourage over-consumption (creating potential for health issues) and increased food waste generation (more likelihood of not finishing whole meal) (2, 37), which feeds back to normalise prevailing social and cultural beliefs.

As economic growth and labour market conditions improve, increased café and restaurant patronage is expected as discretionary household income increases (21).

Interestingly, this may lead to the personal value we ascribe to food being lowered as food and drink appears more accessible and abundant, and food waste consequences are less apparent. This may be further amplified when eating outside of the home environment, such as in cafés and restaurants, where meals haven't been prepared and served by loved family and friends, resulting in reduced intrinsic social value. In this situation customers may be more disconnected from the way their food is produced (33) and prepared, and the waste generated doing so. Furthermore, customers are often absolved of overt responsibility for dealing with plate waste making it less visible as an issue, and consequently, less influenced by societal norms and social signalling (9).

Research also indicates that when a foodservice makes changes to food options available, a temporary increase in food waste can occur due to resultant customer behaviour (9). In practice, when cafés and restaurants make changes beneficial to reducing overall food waste within their business, such as utilising normally wasted produce trimmings and meat cuts, or increasing vegetarian options, customer expectations relating to food consumption rituals and habits may be upset and unmet. Consequently, increased plate waste may result for a time, while customers adapt and become familiar with new meals and food styles offered. Moreover, customer values and plate waste behaviour have been linked to the concepts of hedonism (gaining pleasure and self-gratification) and self-direction (choosing self-goals, especially related to health) (52). The implication being that a range of complex factors need to be considered when developing and implementing customer-related food waste reduction strategies.

2.8 Theoretical frameworks

2.8.1 The systems model

Foodservice operations are dynamic systems that change and respond to meet operational aims, and, customer needs. Designated areas within the system work cohesively to achieve common outcomes, meaning the interdependent nature of these areas must be understood and managed appropriately (54, 55). Payne & Palacio (2016) (55) developed the widely used and easily adaptable systems model (Figure 1) for foodservice, clearly and simply illustrating the integrated and interdependent relationship of designated system areas, within the whole of the operation.

The systems model emphasises that each area can't operate in isolation, meaning changes made in one area impacts the operation and function of the others (55). This is important when considering hospitality food waste, as proposed initiatives to reduce food waste 'outputs' will impact across all system areas within café and restaurant operations. For example, supplier contracts may have to be renegotiated, more time, money and staff inputs may be needed to implement changes, and customer satisfaction and feedback may necessitate changed communication and decision-making functions.

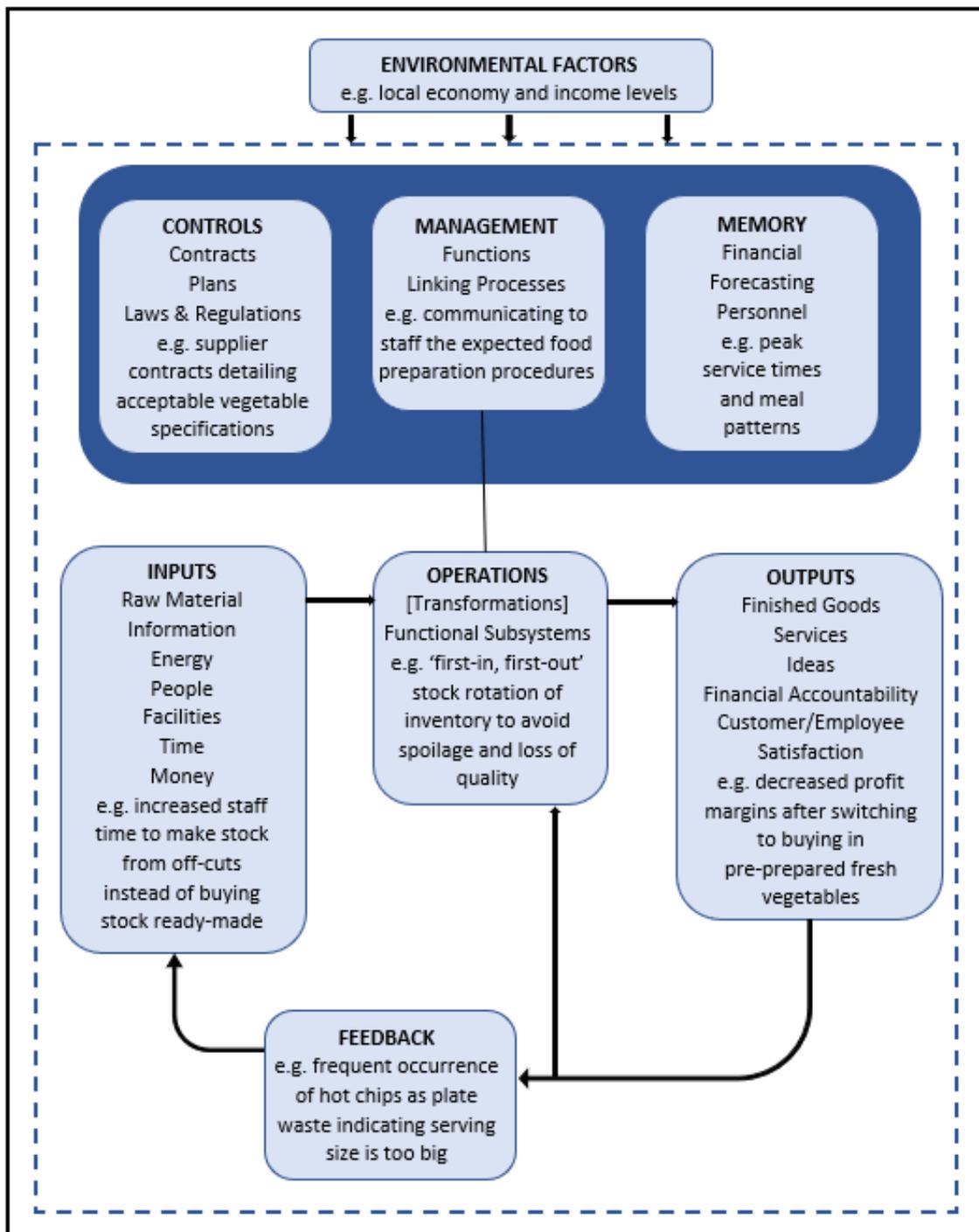


Figure 1. The systems model: adapted from Payne-Palacio & Theis (55)

2.8.2 *The food waste hierarchy.*

Although the food waste hierarchy model (25) is an adaptation of earlier general waste management models, such as the widely known 3 R's (Reduce, Reuse, Recycle), it is not a food waste management hierarchy. Rather than aiding food waste management once generated, it functions to prioritise solutions for preventing and minimising food waste generation in the first instance (25). Integrating sustainable production with sustainable consumption practices, this model prioritises reducing undesirable over-production and over-supply food surplus (beyond meeting human nutritional needs and safeguarding food security) ahead of re-distribution and re-use as next preferred options. Once unfit for human consumption, distinguishing between avoidable and unavoidable food waste informs different preferred ways for utilising it. This subtle shifting of cultural values aims to counter any potential for acceptance and tolerance of food waste that is a consequence of more well-known efforts prioritising recycling.

Accordingly, the food waste hierarchy model (Figure 2) summarises the most to least favourable pathways for minimising and managing food surplus and waste. Although the model proposes a more holistic approach to addressing food waste by considering the three dimensions of sustainability (social, environmental economic), more weight has been given to social and environmental impacts. This leaves the model open to debate regarding the preferred options when viewed solely from an economic aspect, which is undoubtedly an important dimension for café and restaurant businesses.

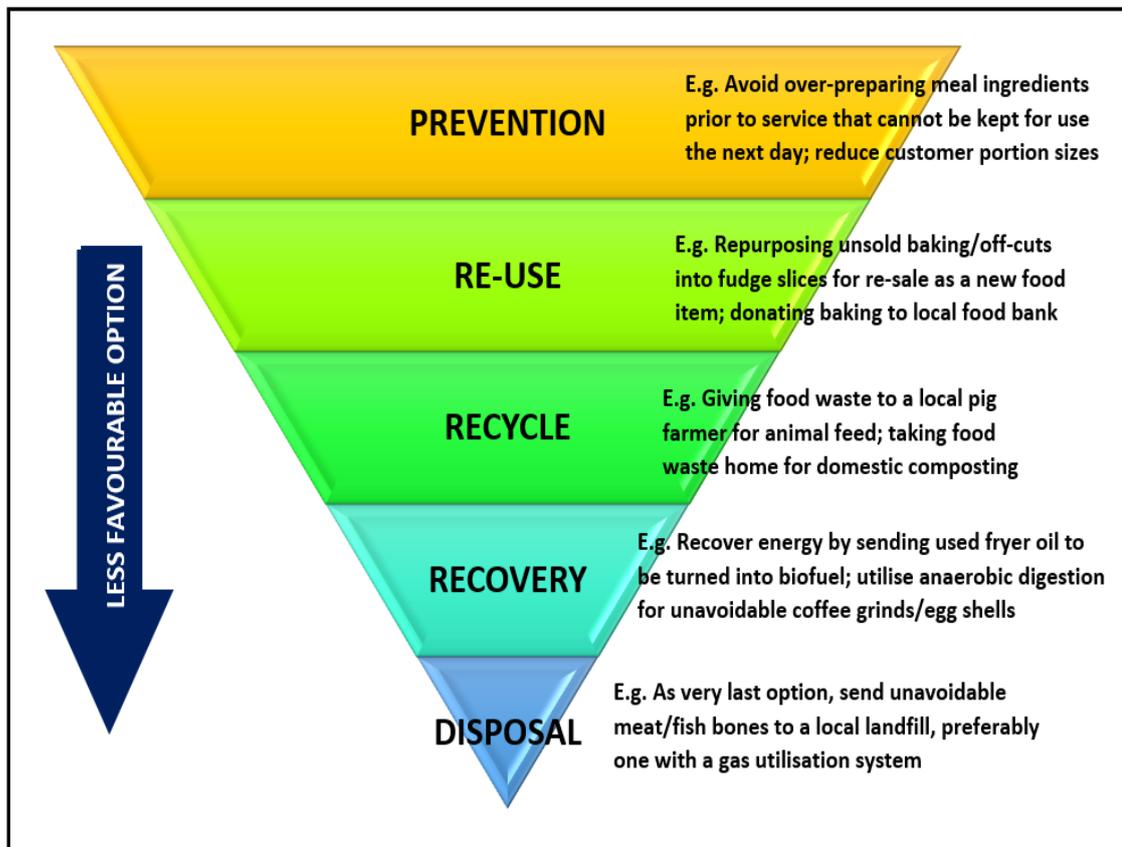


Figure 2. The food waste hierarchy model: adapted from Papargyropoulou et al (25)

2.9 Conclusion

Food waste literature is expanding in accordance with the increasing global attention on food waste generation. Examining economic, social and environmental impacts of food production, harvesting and processing has been a central focus point in existing literature. Foodservice literature is also growing in response to an identified knowledge gap regarding food waste quantification in the consumption setting. In such a diverse industry, hospitality foodservice literature to date has utilised varying quantification methodologies, lacking a coherent and universal approach necessary for meaningful data comparison.

In a competitive sector experiencing significant growth, appropriate food waste quantification and management can increase hospitality business profit and performance while simultaneously appealing to customers via increased environmental sustainability and enhanced dining experience. This present research aims to address a consumption knowledge gap within the New Zealand café and restaurant sector by establishing and quantifying baseline food waste generation data (Section 3.0). This will be achieved by using a mixed-methods approach to gain both qualitative and quantitative data (Section 4.0 and 5.0), creating potential for future research to design industry specific initiatives to reduce food waste generation (Section 6.0).

3.0 OBJECTIVE STATEMENT

Current available food waste literature specific to the foodservice industry has increased alongside food waste awareness, but there is no universal, consistent approach used for measuring and quantifying food waste generation (detailed in Section 2.0). Very minimal research is available for the for-profit café and restaurant sector alone. Furthermore, no existing New Zealand-specific literature was found that provided insight to the quantities and areas where food waste generation occurs within cafés and restaurants nationally. This present research aims to establish baseline knowledge of food waste quantities generated in café and restaurant businesses, assess the areas where food waste generation occurs, and explore their perceptions of the potential impacts, motivators and barriers regarding food waste, and, potential food waste reduction strategies for the future (detailed in Section 5.0 and 6.0).

Research Objectives:

New Zealand café and restaurant self-report and on-site audit data will be used to:

1. Estimate the amount of total and avoidable food waste generated daily,
2. Identify areas where food waste is occurring, and types of food wasted,
3. Assess audit participants' awareness of their total and avoidable food waste, comparing self-report with on-site audit data,
4. Assess participants' food waste-related practices, motives, barriers and perceptions of proposed food waste reduction strategies (likely impact and ease of implementation), and
5. Provide recommendations to inform future food waste reduction strategies that engage the sector in adopting more sustainable practices.

4.0 PARTICIPANTS AND METHODS

4.1 Research study design and rationale

This research is a mixed methods quantitative and qualitative study of hospitality food waste arising within New Zealand cafés and restaurants at a single time point during the year, while employing generalisations as to the perceived usual daily food waste generation for each business.

Self-reported food waste data (via phone or online questionnaire) from all businesses, and researcher-measured food waste data (via 24-hour audit) from a sub-sample of businesses, were collected directly from participants and analysed after data collection.

At present there is no New Zealand-specific data that attempts to quantify amounts and types of food waste generated within the café and restaurant sector. This is therefore an original research thesis serving to both establish baseline knowledge regarding food waste in this sector, and provide data to inform appropriate future food waste reduction initiatives. This research also contributes to the consolidation of existing New Zealand food waste data from various sectors (e.g. domestic, hospitals and airlines).

4.2 Research study ethics

This research was approved by the Department of Human Nutrition and the Human Ethics Committee (Appendix A). All participating businesses were provided verbal and/or written information and opportunities to ask additional questions at any time during the study. Informed consent (verbally/electronically) was given prior to undertaking the self-reported questionnaire, with knowledge that questionnaire completion also served as giving consent. Additional consent (verbal/written) was

given prior to participation in the 24-hour food waste audit undertaken on-site at each premise (Appendix B).

4.3 Participant selection and recruitment

This research was one part of an overall two-part Master of Dietetics research project which aimed to establish baseline data regarding food waste generation by the New Zealand Café and Restaurant sector. To provide a clear differentiation between both projects, geographical regions were utilised to divide the total number of Food and Beverage Services Businesses in New Zealand (representing the assumed national distribution of Restaurant/Café businesses) into two approximately equal groups.

Accordingly, the geographical area for participant recruitment in this research project was defined as all regions of New Zealand excluding the Upper North Island (Auckland, Northland and Waikato/King Country/Thames Valley regions), which were allocated to the second Master of Dietetics research project (Appendix C).

A sample of 250 New Zealand café and restaurant businesses were randomly selected with the aim of recruiting 150 participants as the desired food waste questionnaire sample size, and retaining 15 participants as the desired on-site food waste audit sub-sample size. All businesses listed under either 'Cafés and Coffee Bars' (no stand-alone Café category was available) or 'Restaurants' (including Licensed, Unlicensed and BYO) categories in the current 2016-2017 Yellow Pages (hardcopy phone books), located in the Dunedin Public Library, were included as eligible to take part in this research.

Using Microsoft Office EXCEL 2016 (Figure 3), each business was entered in a spreadsheet (3198 in total within the geographical area this thesis is reporting on), assigned a random number using the '=RAND()' function, and sorted to randomise the

list to be approximately representative of each geographical region. The first 250 listed businesses were assigned as the research sample and de-coded to obtain contact details for each.

	A	B	C	D	E	F
1	Region	Business Type	Business Listing	Random_number	Business Name	Business Phone
2	MARLBOROUGH	R-FL	32	0.874404477		
3	WELLINGTON	R-BYO	57	0.462993003		
4	MANAWATU	R-BYO	13	0.835784133		
5	WELLINGTON	C	39	0.067171458		
6	WELLINGTON	R-FL	138	0.819331531		
7	OTAGO	C	128	0.411492185		
8	MARLBOROUGH	R-FL	34	0.619748357		
9	GISBORNE	R-FL	4	0.763382528		
10	MANAWATU	R-BYO	11	0.804462816		
11	TARANAKI	R-FL	7	0.215531384		
12	WAIRARAPA	C	15	0.545310724		
13	TIMARU/OAMARU	R-FL	31	0.343518491		
14	CHRISTCHURCH	C	226	0.025590641		

Figure 3. Example of the Microsoft Office Excel 2016 spreadsheet used to create the randomised sample listings.

Each individual business was contacted by phone and invited to participate in the questionnaire, either via phone or an emailed link to an electronic version. Of businesses that completed the questionnaire, those consenting to participate further in a voluntary audit, generated the pool for recruiting a sub-sample to undertake on-site 24-hour food waste audits.

However, multiple factors including the busy nature and time pressure of café and restaurants operations, limited ability to build rapport over the phone, and difficulty obtaining access to appropriate business representatives resulted in a very low response rate. Consequently, research methodology was adapted to employ a convenience sample to increase overall participation rate and data quality. This approach saw the researcher visit additional businesses to invite questionnaire participation. Accordingly, elements of bias were introduced due to non-randomisation, the restriction of

undertaking business visits in the local drivable area (within 230km both north and south of Dunedin), and business visits occurring predominantly during the day and outside of peak service periods to increase staff engagement.

Although businesses from the randomised sample consented to audit participation, all were dispersed across small centres, predominantly in the North Island. This made it logistically and economically unfeasible to travel to these businesses to undertake an audit within the time and budget constraints of this research. Consequently, consenting businesses from the convenience sample alone formed the recruitment sub-sample for undertaking audits as part of this research.

4.4 Data collection

The student researchers worked together to develop the research protocol (Appendix C), guided by current best practice recommendations and supervisor feedback (13, 17, 18, 43).

4.4.1 Part one: food waste questionnaire

Questionnaire development was based on a comprehensive UK template (18), where the preferred questionnaire administration was verbally over the phone. The researcher adapted the basic design and contents to be appropriate within the New Zealand context, and to meet the scope and limitations of this research. Further guidance for qualitative-based questions was taken from a recent New Zealand household food waste study (43), commissioned by an organisation recognised as an authoritative voice regarding food waste and reduction strategies within our local context. This allowed adaptation of an existing format, while enhancing consistency between New Zealand FSC sectors where data is currently known, or being established.

The research study design aimed to elicit both self-reported quantitative (e.g. food waste amounts and types, daily covers, current food waste practices) and qualitative (e.g. perceptions of impact and feasibility for potential strategies, motivations to reduce food waste) data, and willingness for participation in an on-site food waste audit if selected.

An introductory blurb was embedded in the questionnaire to provide context regarding the research purpose and nature, outline participation expectations and outcomes, and gain informed consent from willing participants. Efforts were made to provide adequate and consistent definitions pertaining to food waste streams (e.g. food spoilage, food preparation and customer plate waste), as guided by key documents (13, 16, 19).

The researcher created a Qualtrics account (56) through the University of Otago, allowing translation of the verbal questionnaire into an online version. This enabled an embedded link to the online questionnaire to be emailed to businesses preferring this option.

The questionnaire underwent a review process prior to use. This involved engaging feedback from Jenny Marshall, of WasteMINZ, who has expertise in the food waste field. Feedback was also obtained from researcher peers (n=3) with experience working in foodservice operations and from the primary supervisor of this thesis project who has experience in undertaking food waste research. Accordingly, changes were implemented to improve consistency, clarity and ease of use of the final version.

All randomly selected businesses were initially contacted by phone to determine the most appropriate person to speak to regarding questionnaire participation, and their availability. Multiple phone calls per business were frequently required due to the call going answered, unavailability of the appropriate person, or the present time being

inconvenient. While ideal administration was verbally via phone, nearly all businesses opted for the online link to enable potential completion when convenient. A personalised email to each business consequently became the primary administration method used.

As the need to employ a convenience sample was identified during data collection, the online questionnaire was translated into an identical hardcopy version that was printed and provided to all businesses invited to take part in this sample group (Appendix D). The researcher approached trading businesses in person, consciously avoiding peak meal service times (before 9am, between 11.30am and 1.30pm, after 5.30pm). The most appropriate staff member was identified and invited to complete a hardcopy questionnaire. A self-addressed, pre-paid envelope was supplied to businesses outside of Dunedin to enhance both convenience and the likelihood of participation. To optimise convenience and participation of Dunedin businesses, follow-up was undertaken as dictated by each business, including a pre-determined day and time to collect the completed questionnaire, text reminders as requested, and supplying researcher contact details for businesses to use if participation occurred.

4.4.2 Part two: on-site food waste audit

Development of the audit protocol employed a mixed methods design, again adapted from the same comprehensive UK template (18). Initial aims were to obtain observational, self-reported and researcher-measured data relating to on-site food waste generated at each participating business. Main design points took guidance from key documents (13, 16-18, 42), including capturing distinct data for food waste generation streams (food spoilage, food preparation, customer plate waste), separation into thirteen defined food groupings within each stream, and further separation of each food

grouping into avoidable, potentially avoidable and unavoidable food waste (Appendix C).

The researcher obtained or purchased audit equipment needed to meet protocol and practical requirements. This included tarpaulins, disposable gloves, rubbish bags, bin liners, standard kitchen scales (weights up to 4kg), anthropometric scales (weights exceeding 4kg) and a selection of rubbish bins (48L), buckets (9L–10L) and containers (2L-4L) of varying capacity.

The researcher developed food waste bin labels (Figure 4), attached to each bin utilised by businesses during the audit period. Each label included the waste stream name, definition (as used in the questionnaire), and six examples of appropriate food items (Appendix E). This served to optimise food waste being correctly allocated into bins, provided a quick reference point to lessen the inconvenience of waste separation required, and, aided communication of the audit process between staff for when shift changeovers occurred during the audit period.



Figure 4. Example of a bin label attached to food waste bins during audit data collection

The researcher translated defined waste streams and food groupings into a hardcopy audit sheet for the purposes of recording measured data for each audit undertaken. An additional column was included to record specific food items appearing, to identify potential commonalities during data analysis (Appendix F). An identical version was created in Qualtrics to enable audit data to be entered and stored online.

Audit participants were selected from the pool of businesses that consented to participate during questionnaire completion. However, financial, time and logistical challenges arising from the geographical spread of mainly North Island locations, made it unfeasible to undertake audits with all consenting businesses. This necessitated a protocol amendment, whereby audit participants were recruited solely from consenting southern-based convenience sample businesses. As this comprised 13 businesses in total, all were selected for recruitment.

The researcher contacted each business, either in person or via phone, to arrange an audit date and time that best-suited the business, and which the researcher could manage. The researcher arrived at the agreed time with the required equipment, including a range of bin and container options for the business to select sizes that best fit their needs and kitchen space.

After bin selection corresponding bin labels were attached, and each bin was lined with a rubbish bag/bin liner of appropriate size, and spare liners were provided (Figures 5-6). Brief food waste segregation education was provided to the business contact and any staff present emphasising the use of designated bins only. Before leaving, researcher contact details were left with the business to make contact if any issues or questions arise during the audit period, and formal written consent was gained except for four circumstances that required verbal consent.



Figure 5. Example A showing bin sizes selected for use during an on-site audit



Figure 6. Example B showing selected bins in position on-site during an audit

The researcher returned approximately after a 24hourperiod to maintain consistency and collected the bins and food waste within. This time was used to talk with the business regarding their audit experience, and gain additional qualitative data regarding

perceptions, barriers, and any circumstances that influenced the resultant food waste generated.

The researcher carried out sorting of each food waste audit at home, rather than at the business premise, due to the realities of limited space, hygiene considerations, and the need to limit any further inconvenience to staff and disruption of business operations. Additionally, time and logistical requirements of sorting, categorising and weighing each collection of food waste meant having easy access to running water, cleaning equipment, toilet facilities and food/drink during breaks were essential.

Weight, expressed in grams, was chosen as the unit of measurement for quantifying food waste amounts, to align with best practice recommendations (13) and maintain consistency with guiding literature (18). Each audit was undertaken in a systematic, step-wise process to measure data from each food waste stream separately. The researcher removed the bin liner containing food spoilage waste and recorded the total weight (minus known bag weight) generated during the 24-hour period. Food waste within was sorted into one of thirteen separate containers (Figures 7-8), each representing a defined food type grouping (Table 4.1), as guided by a UK-based protocol (18).

Each food groups total weight was recorded (minus container weight), followed by further separation into, and weighing of, avoidable, potentially avoidable and unavoidable food items. This process was then repeated separately for both food preparation waste and customer plate waste (Appendix G).



Figure 7. Example showing food preparation waste sorted into containers by food type grouping



Figure 8. Example showing customer plate waste sorted into containers by food type grouping

After each audit, all meat and fish waste was wrapped and disposed of in a domestic rubbish bin. All remaining food waste was placed back into bin liners, stored in sealed pails and delivered to a pre-arranged contact who was happy to take receipt of this food waste for personal composting.

Table 4.1. Food type groupings used to sort 24-hour audit food waste

FOOD TYPE GROUPING	FOOD ITEMS INCLUDED
Fruit	All types including inedible parts
Vegetables	All types including inedible parts
Potatoes	All types and forms (chips/fries/skin/whole/mashed)
Meat	All types and forms including inedible parts (flesh/bones/fat/skin)
Fish	All types and forms including inedible parts (flesh/bones/skin/guts)
Dairy	All types including dairy alternatives (cream, butter, cheese, soy/almond milk)
Eggs	Including inedible parts (eggshells, yolk, whites)
Bakery	Includes all types of bread, pastry, muffins, scones, rolls, tarts
Cereals & Grains	Including rice, pasta, couscous, noodles, other grains
Legumes, Nuts & Seeds	Including lentils, pulses, beans, nuts, seeds
Packaged Liquids	Any not already included in another category (e.g. liquid oils, soups, beverages. Excludes milk).
Miscellaneous	Any food waste that does not fit into any of the defined food categories (lollies, condiments, herbs & spices, coffee grounds, tea bags)
Unidentified Food Waste	Any visually unidentifiable food waste unable to be allocated to a food category.

4.5 Data analysis

When data collection was complete, separate default Qualtrics reports were created for both the questionnaire and audit data as Microsoft Office Word 2016 documents. The questionnaire report provided raw number counts and percentages, used to summarise general participant characteristics. The audit report provided data by individual measure in list form (e.g. fruit grouping avoidable weight totals listed for each business), enabling easier viewing and access to data during analysis.

Questionnaire data was exported from Qualtrics into a Microsoft Office Excel 2016 spreadsheet. The spreadsheet (Figure 9) was used to manually calculate results, which are depicted in graph and table form (Section 5.0). Audit data was manually entered into a spreadsheet (within the same workbook), allowing collation and calculation of results, both as a separate entity and when matched against corresponding questionnaire data for intra-business comparison purposes.

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Self-reported clas	Self-reported	Do most of you	Which of the	Approxim	What days of the week	How man	Approxim	Approxim	Does your	Do you m	If yes, how	Approxim	Approximat
2	Cafe		About equal ar	Breakfast, Mor	51-100	7 days	52	2.5 x 60L	1 x contain	No	No	No - due t	20 to 39%	Less than 20%
3	Cafe		About equal ar	Breakfast, Mor	51-100	Mon-Saturday	50	1 per wee	2 per wee	Yes	Yes	We	Less than	Less than 20%
4	Cafe		About equal ar	Breakfast, Mor	51-100	7 Days	52 Weeks	120L (0.5 x	-	No	Yes	-	Less than	Less than 20%
5	Cafe		About equal ar	Breakfast, Mor	51-100	7 Days	52 Weeks	4 x 70L an	3 x 45L Bir	No	No	(No answe	I don't kn	I don't know
6	Cafe		About equal ar	Breakfast, Mor	51-100	6 days (Mon - Sat)	52 Weeks	100L (3 x 2	We recycl	Yes	Yes	We really	Less than	Less than 20%
7	Cafe		About equal ar	Breakfast, Mor	51-100	5 Days (Mon - Fri)	49 Weeks	1 x Black r	15-20 Plas	No	Yes	We recor	Less than	Less than 20%
8	Cafe		About equal ar	Morning brea	51-100	6 Days (Closed Monday)	52 Weeks	1/4 x bag	1/5 x bag	Yes	No	No need t	Less than	Less than 20%
9	Cafe AND Restaurant		About equal ar	Breakfast, Mor	51-100	7 days	52	No answe	1 x 72L bag	Yes	Yes	Food wast	20 to 39%	Less than 20%
10	Cafe AND Restaurant		About equal ar	Breakfast, Mor	51-100	6 Days (Mon - Sat)	51 Weeks	2 x 65L Bag	0	No	Yes	Records o	Less than	Less than 20%
11	Cafe AND Restaurant		About equal ar	Breakfast, Mor	101-200	7 days	52 weeks	2 x 80L bir	None	Yes	No	No answe	Less than	Less than 20%
12	Cafe AND Restaurant		About equal ar	Breakfast, Mor	201-300	7 Days	52 Weeks	1 x 60L bir	1 x 60L bir	No	No	We used t	Less than	Less than 20%
13	Other	Eatery	About equal ar	Breakfast, Mor	51-100	7 Days	49 Weeks	1 x 45L bir	Whatever	Yes	Yes	We write	Less than	Less than 20%
14	Restaurant		About equal ar	Lunch, Dinner,	101-200	7 Days	52 Weeks	1 x 240L Bi	1 x 240 L B	No	No	We used t	Less than	Less than 20%
15	Cafe		Eat their food	Breakfast, Mor	51-100	7 days	52	70 Litres	(60 L	Yes	Yes	Visual mo	Less than	Less than 20%
16	Cafe		Eat their food	Breakfast, Mor	51-100	5 Days (Mon - Fri)	-	-	-	No	No	-	I don't kn	I don't know
17	Cafe		Eat their food	Morning brea	51-100	6 Days	52 Weeks	0.5 x 80L b	Boxes (car	No	No	It is not o	Less than	Less than 20%
18	Cafe		Eat their food	Breakfast, Mor	101-200	7 Days	51 Weeks	3 - 4 x 60 L	2 x 60 Litre	Yes	Yes	-	Less than	Less than 20%
19	Cafe		Eat their food	Breakfast, Mor	101-200	7 Days	50 Weeks	69L (2 x 24	55L (1 x 36	Yes	Yes	We are a	Less than	Less than 20%
20	Cafe		Eat their food	Breakfast, Mor	201-300	6 days (Monday - Satur	52	1.5 x 20L	b 0.5 x 20L b	No	Yes	Sight bin	20 to 39%	Less than 20%

Figure 9. Example of Microsoft Office Excel 2016 spreadsheet showing exported Qualtrics data, used to collate data and calculate results

Audit data was first analysed as a separate entity to calculate both absolute, percentage and mean values. Audit data was then matched with corresponding questionnaire data for each participating business, to allow comparative analysis to explore trends between perceived and actual food waste generation. The researcher then looked for relevant ways to group and compare participants to identify potential food waste trends for this sector. Given the small sub-sample size of audit participants, the undertaking of regular food waste monitoring was chosen as a comparison characteristic for audit data analysis. This produced a near even split of six businesses in the regular monitoring group and five in the non-monitoring group.

Additional recorded qualitative data pertaining to motivators, perceptions and barriers was collected from participants during data collection through conversation, on-site visits, open questionnaire questions, and comments written on hardcopy versions. This data was analysed and grouped by dominant themes with results presented by representative participant direct quotes or a researcher interpreted summary.

5.0 RESULTS

The following chapter describes the participation outcomes of the research data collection process (5.1), and summarises key characteristics of participating café and restaurant businesses (5.2). Key quantitative and qualitative results from the self-reported questionnaire data (5.4) and the researcher-measured food waste audit data (5.5) are reported on separately. This was done to maintain the accuracy of the findings given the difference in participant numbers and the loss of randomisation of the final samples. The exception to this is the comparison of self-reported data with researcher-measured data for each business that participated in the audit. In this case, the researcher matched the correct audit data for each business with their corresponding self-reported questionnaire data. Lastly, key findings from both questionnaire and audit data are presented as an overall summary (5.6).

5.1 Participation outcomes

Participation numbers and participant retainment from the original randomised sample group are shown in Figure 10, including the very low response rate for questionnaire completion (5.2%, 13 of 250 businesses). The consequent inability to undertake any of the potential audits (7 businesses) from this sample was due to one business being sold prior to auditing, one participant's questionnaire and audit consent being received in the post over a month after data collection finished, and the geographical spread of the remaining five business locations, making it both financially and logistically unfeasible for the researcher to utilise (detailed in Section 4.0).

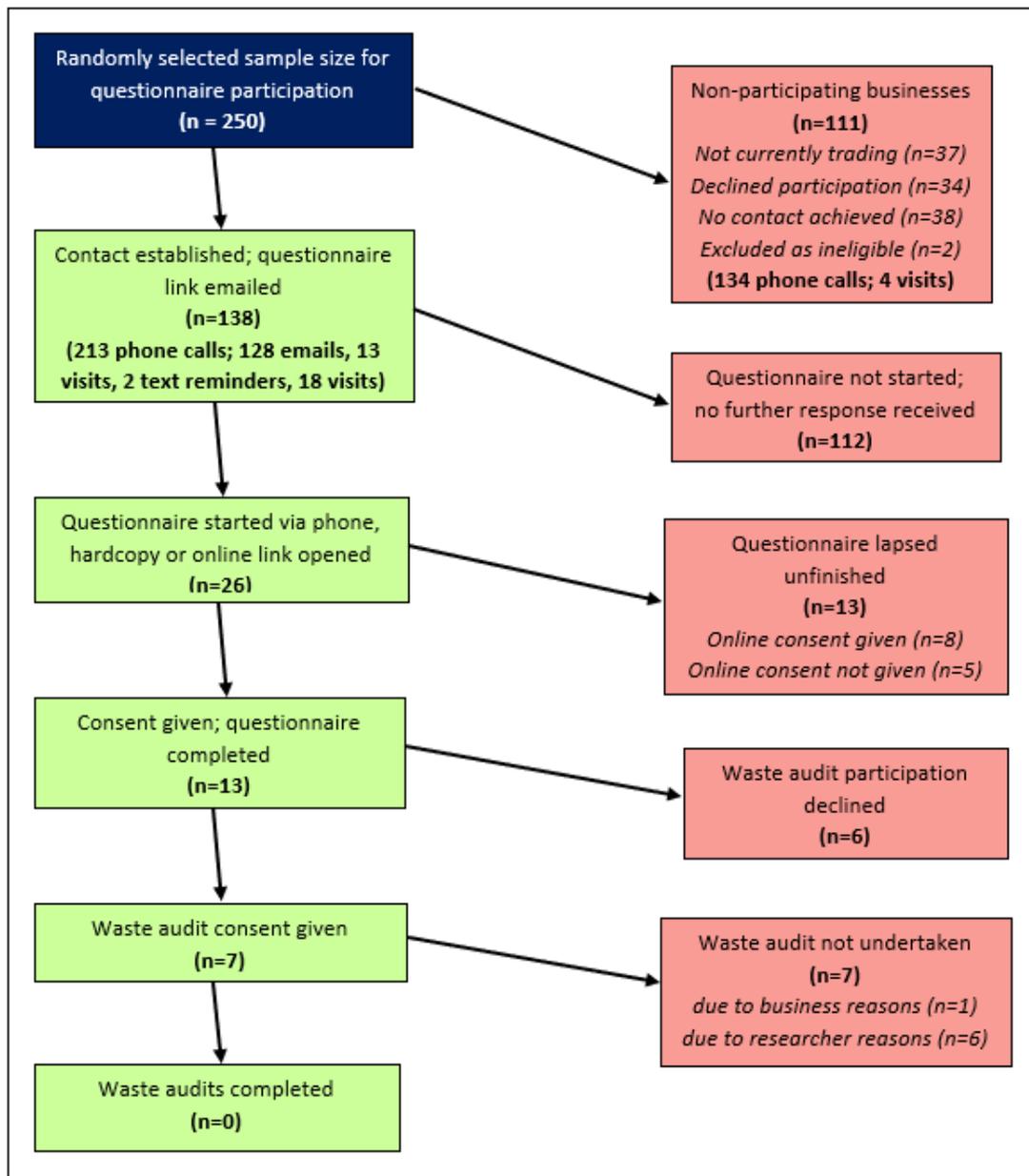


Figure 10. Randomised sample group participation during data collection

This necessitated the employment of a non-randomised convenience sample to increase overall participant numbers, as shown in Figure 11, achieving a response rate of 26.5% (18 of 68 businesses) for questionnaire completion. Although 13 participants (19.1%) consented to audits, space and timing constraints prevented two from participating, resulting in the successful completion of 11 audits.



Figure 11. Convenience sample group participation during data collection

5.2 General participant characteristics

The 31 café and restaurant businesses that participated in this research displayed considerable diversity relating to daily covers served (takeaway coffee and bakery item versus full sit-down dinner), style of food produced (vegan versus meat-centred), food ethos (sustainable nutrient-dense ‘whole’ food versus mainstream nutrient-poor convenience foods), premise atmosphere (modern and minimal versus dated and

cluttered) and staff perceptions around food waste and associated issues. A dominant geographical spread among smaller towns and rural areas resulted from the randomised sample, with a notable absence of participants from main centres such as Wellington and Christchurch. However, this was partly masked by the inclusion of convenience sample participants which over-represented the Otago, Southland and Oamaru/Timaru regions.

Staff at each business self-determined who was the most appropriate contact person for questionnaire completion. Food waste data was therefore provided from the perspective of a variety of business roles, including business owner, owner-operator, director, head chef/chef and duty manager/manager.

General self-reported participant characteristics are summarised in Table 5.1. While most classified themselves solely as a Café, three businesses identified with the additional terms ‘eatery’, ‘bar & out-catering’ and ‘bakery’ respectively. All but two businesses reported at least 50% of food served to customers is consumed on their premise and the majority open for trading at least six days per week, every week of the year.

At least two thirds of participants catered for each meal type, the notable exception being dinner meals, which only 40% offered. This is partly an effect of the convenience sample where selection was influenced by opening hours when undertaking face-to-face questionnaire recruitment.

Table 5.1. General characteristics for all participating café and restaurant businesses

CHARACTERISTIC	NUMBER (%)
Self-reported business classification	
Café	17 (55)
Restaurant	6 (19)
Café AND Restaurant	5 (16)
Other	3 (10)
Geographical location (Yellow Pages Region)	
Marlborough	1 (3)
Timaru/Oamaru	6 (19)
Manawatu	2 (6)
West Coast/Buller	1 (3)
Taranaki	1 (3)
Otago	14 (45)
Southland	4 (12)
Whanganui	1 (3)
Gisborne	1 (3)
Main location where customers consume purchased food	
Eat their food on the premises	16 (52)
About equal amounts take food away as eat on the premises	13 (42)
Take their food away from the premises	2 (6)
Approximate daily covers served	
26 - 50	1 (3)
51 - 100	17 (55)
101 - 200	7 (23)
201 - 300	3 (10)
More than 300	1 (3)
Business doesn't know	2 (6)
Trading days per week	
7 Days	15 (49)
6 Days	9 (29)
5 Days	6 (19)
4 Days or less	1 (3)
Trading weeks per year	
52 Weeks	19 (61)
51 Weeks	3 (10)
50 Weeks	5 (16)
49 Weeks	3 (10)
48 Weeks	1 (3)
Daily meal types provided	
Breakfast	25 (81)
Morning Tea	28 (90)
Lunch	29 (94)
Afternoon Tea	27 (87)
Dinner	12 (40)

CHARACTERISTIC	NUMBER (%)
Dinner	12 (40)
Snacks	25 (83)
Take-aways	21 (70)
Regular monitoring of food waste generation occurs	
Yes	20 (65)
No	10 (32)
Answer not provided	1 (3)
Use of policies/procedures to limit or reduce food waste generation	
Yes	27 (87)
No	4 (13)

Of note, 27 of 31 participants self-reported having policies and/or procedures in place to reduce their food waste generation, while only 20 regularly monitor their food waste produced. Accordingly, policies/procedures to reduce food waste have been implemented in some business operations without staff actively undertaking any monitoring of amounts generated.

5.3 Statistical analysis of food waste data

Data was analysed using descriptive statistics.

5.4 Part one: analysis of self-reported questionnaire data

5.4.1 Food waste generation in overall terms

Every participant that provided an approximation of their total food waste, identified it as comprising less than 40% of the general waste generated by their business, with the majority of participants reporting it as being less than 20% (Figure 12). A similar trend was seen for participants (n=29) who provided an approximation of the proportion of their total food waste considered avoidable. The majority (n=27) self-reported their avoidable food waste as being less than 20%, while one participant reported their

avoidable food waste as between 20% and 39% and one participant reported they didn't know.

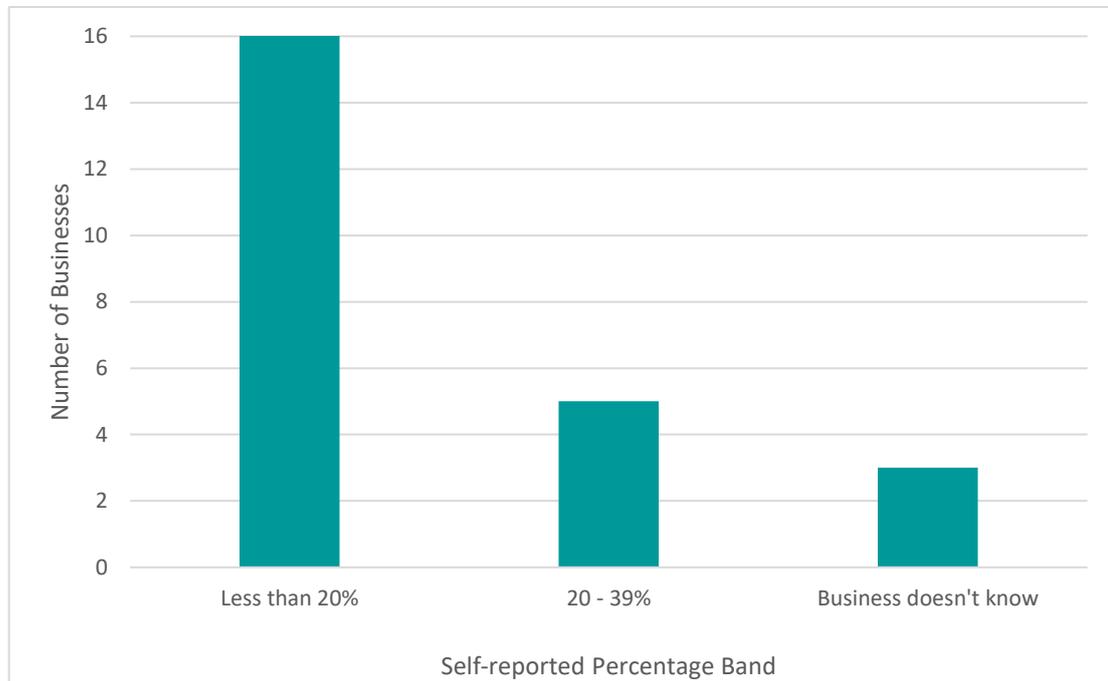


Figure 12. Self-reported percentage band that total food waste contributes to business total general waste (n=29)

5.4.2 Food waste generated by stream type

A wide range was seen in the self-reported percentages that each of the three food waste generation streams (food spoilage, food preparation, customer plate waste) contributes to each business' total food waste. This was seen between businesses within each separate stream, as well as between streams, as to which contributed the largest proportion to total food waste.

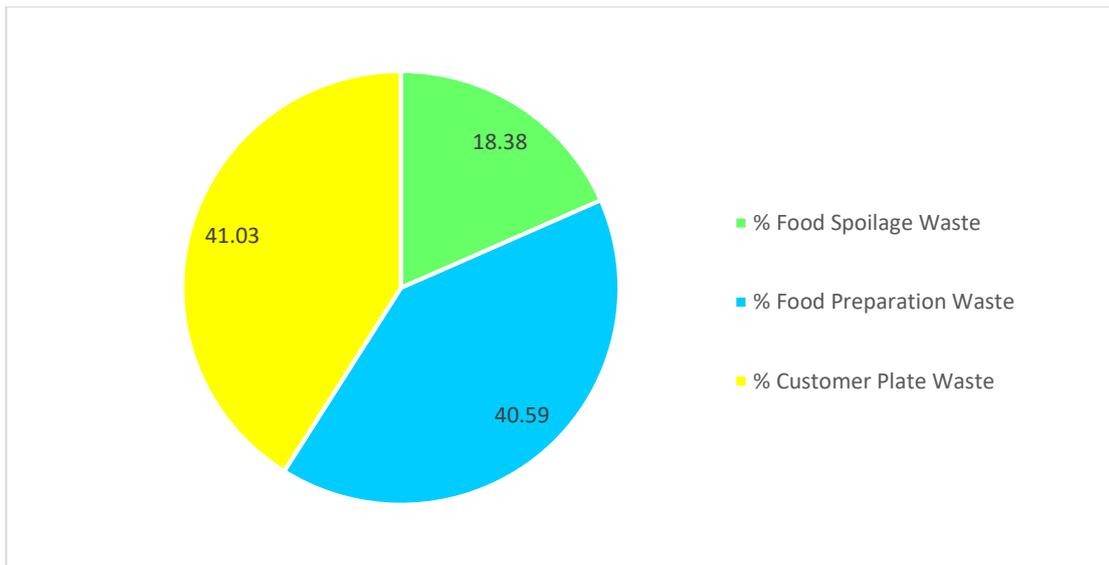


Figure 13. Mean self-reported percentage that each food waste stream contributes to total food waste, for all businesses combined (n=29)

When the mean percentage contribution of each food waste stream was combined for all participants that provided data, the proportions contributed from both customer plate waste and food preparation waste were relatively similar, with less than 1% difference (Figure 13). The mean percentage of food spoilage waste was considerably less, only contributing approximately half of the individual contributions from each of the other two food waste streams.

Analysing the data by individual participants, the large variation in self-reported total food waste contributions of each food waste stream becomes much more apparent (Figure 14). Large ranges were seen in each food waste stream, with food spoilage contributions between 0% and 90%, food preparation contributions between 10% and 100%, and customer plate waste contributions between 0% and 85%. In terms of what food waste stream generated the largest percentage of total food waste, 13 participants identified this as customer plate waste, 11 identified food preparation waste while five

identified food spoilage waste. This also roughly reflects the mean percentage contributions of each food waste stream as previously described.

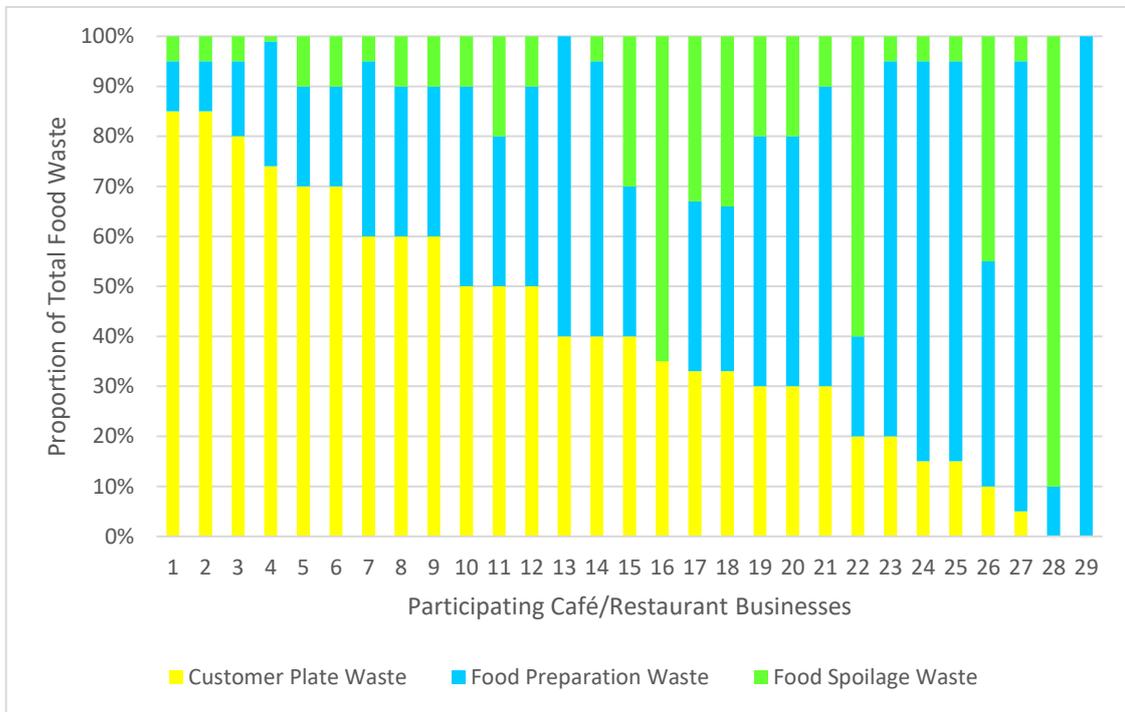


Figure 14. Self-reported percentage that each food waste stream contributes to total food waste generation by individual business (n=29)

5.4.3 Self-reported most common items wasted in each food category

The questionnaire asked each participant to rank the five most common food items wasted within each food waste stream. While only nine participants provided all the requested data, another 15 reported at least one commonly wasted food in each food waste stream. Seven participants provided no data for at least one food waste stream, of which three reported they didn't generate any food waste in that stream and two reported they didn't have the knowledge to answer this section.

As the questionnaire did not provide prompts or examples of food items, a wide range of individual terms, both broadly generic and very specific in nature were reported by

participants. Consequently, the researcher grouped similar specific terms together under a more generalised food type, based on key themes identified within responses. For example, the food type 'Spreads/Sauces' encompassed specified food items, such as 'butter', 'pesto', 'guacamole', 'jam', 'cream cheese', 'relish' and 'tomato sauce', as well as generic terms 'sauce' or 'spreads'. These items were grouped together as they tend to be provided as accompanying items, to be spread or applied to other purchased meal/snack items.

In another example, the food type 'Vegetables' included terms specifying individual vegetables, such as 'pumpkin skin', 'carrot peels', 'lettuce stalks' and 'onion tops', as well as generic terms including 'vegetables', 'vege peels', 'vegetable trimmings', 'green veges', 'vege leaves/stalks' and 'vege discards'. However, the term 'Salad' was left as a distinct food type from 'Vegetables', primarily due to the frequency this exact term was self-reported (especially for customer plate waste), and researcher inability to determine the main component (e.g. rice, pasta or potato-based salad versus vegetable-based).

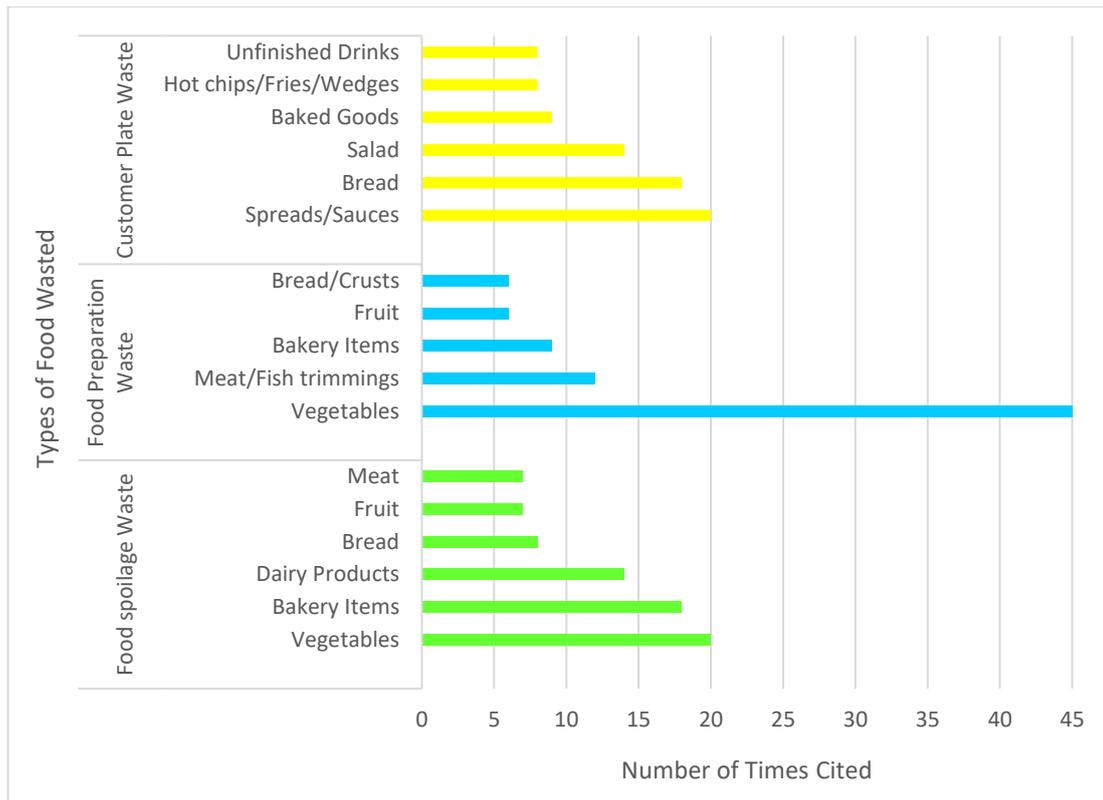


Figure 15. Most common self-reported food item types contributing to café and restaurant food waste, within each food waste generation stream (n=28)

These food term groupings have been employed to clearly illustrate any potential trends emerging for commonly wasted food types within, and between, food waste streams.

This can be seen in Figure 15 where both food spoilage and food preparation waste streams share the same top five food types (excluding the additional presence of dairy products as food spoilage), albeit in a different ranked order. For customer plate waste lower-value food types feature strongly, especially low-value carbohydrate foods such as potato-based products, bread and bakery items.

Vegetables are the most commonly self-reported wasted food type contributing to both food spoilage and food preparation waste. However, many participants reported very specific vegetable items in more than one space within each of these food waste streams.

5.4.4 Strategy impact, implementation and motivating outcomes

The questionnaire listed 13 potential strategies for reducing café and restaurant food waste, of which participants rated the level of impact each strategy would have on their business (Figure 16). For most potential strategies participants were reasonably divided in their perceptions of how much impact each strategy would have on reducing their food waste. Exceptions to this include the strategies focused on employing a ‘first-in, first-out system for stock rotation’, and ‘ordering smaller amounts, more often, of stock with a short shelf life’ that is vulnerable to spoilage.

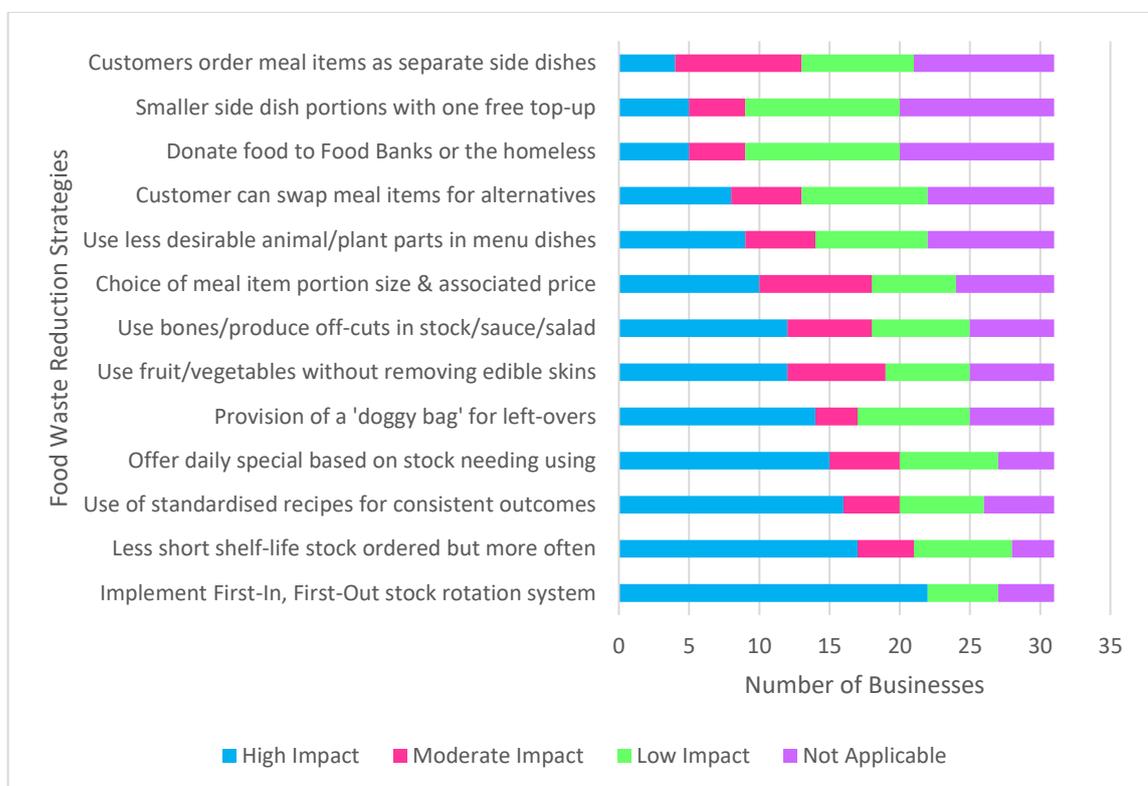


Figure 16. Self-rated level of impact of each potential strategy for reducing café and restaurant food waste (n=31)

Both these strategies were predominantly rated as high impact with a less even distribution among other impact levels. Donating leftover food to food banks or the homeless, and serving smaller side dishes with an option of a free top-up on request,

were the two strategies that received the largest amount of low-impact ratings for reducing food waste.

In conjunction with self-rating strategy impact levels, participants also rated the ease of implementation for each potential strategy (Figure 17). While results show there is still a range of ratings for how easy or difficult each strategy implementation is perceived to be, a trend can be seen towards a larger proportion of participants considering many strategies as easy to implement. Additionally, a trend can be seen where many potential strategies, rated as high-impact for food waste reduction by the largest proportion of participants, also have the largest proportion of participants rating them as easy to implement.

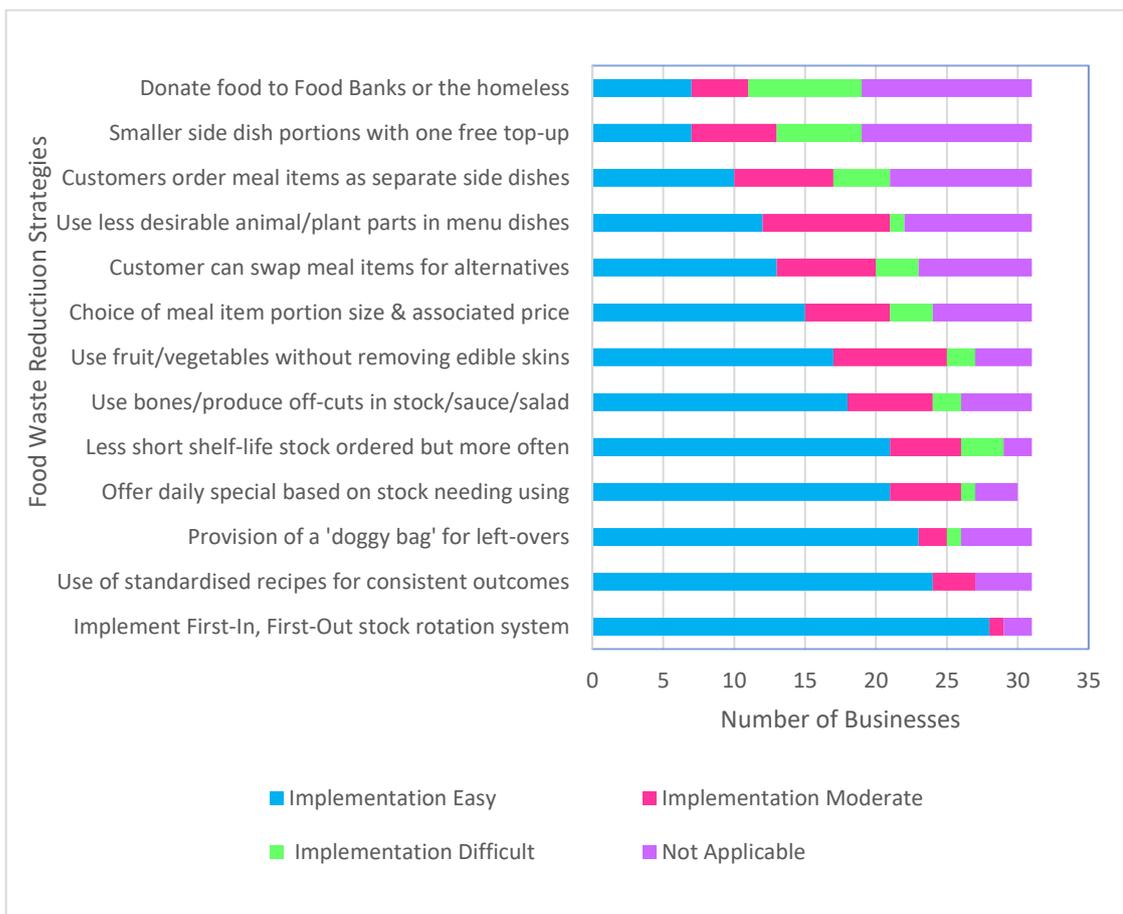


Figure 17. Self-rated ease of implementation of each potential strategy for reducing café and restaurant food waste (n=31)

Some participants reported selecting ‘not applicable’ for strategies they have already implemented, for both level of impact and ease of implementation, as they were no longer ‘potential’ strategies. Others reported rating strategies according to their actual experience of implementing them. Contrastingly, some participants reported selecting ‘not applicable’ for strategies they have not employed (as opposed to what they perceived the impact and implementation would be), considering these as irrelevant.

The range of importance given to four specified outcomes for providing motivation to reduce food waste is shown in Figure 18. Nearly two thirds of participants (20 of 31) self-rated financial outcomes (saving money) as being an extremely important motivator for reducing food waste. This increased to 97% (30 of 31) for ratings of very important and extremely important combined.

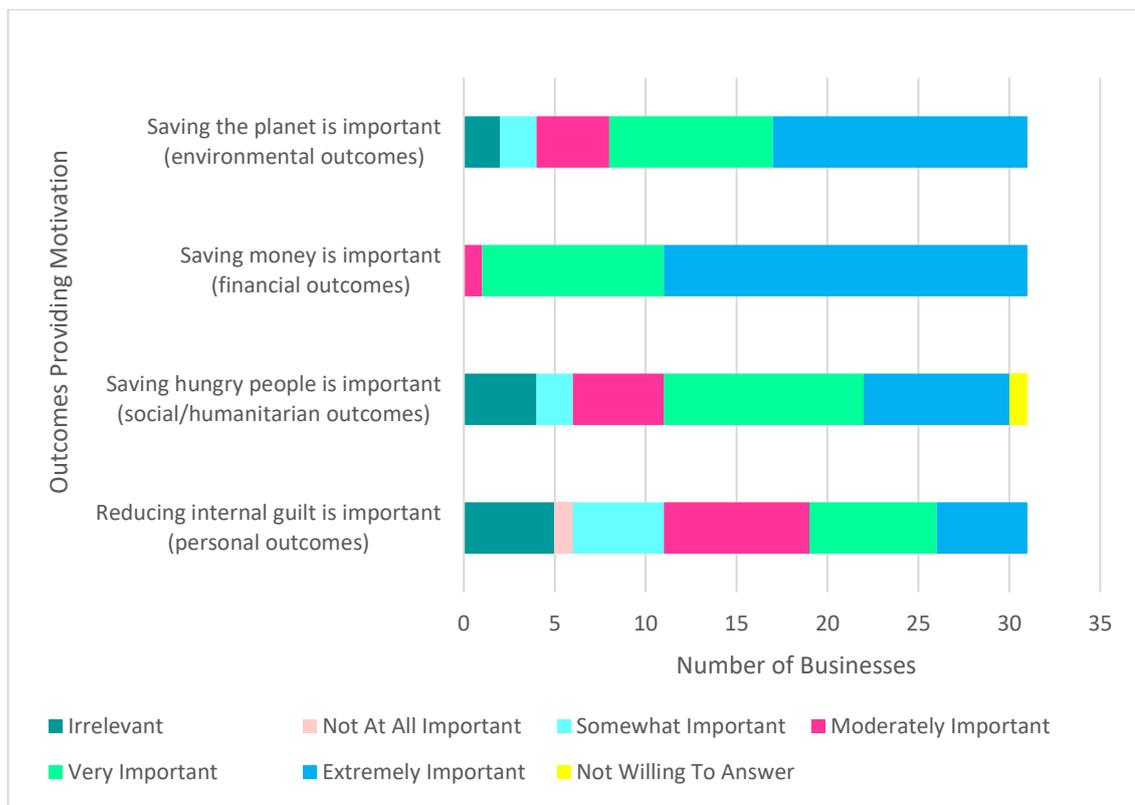


Figure 18. Self-rated level of importance given to different outcomes for motivating cafés and restaurants to reduce their food waste (n=31)

Environmental outcomes (saving the planet) are another important motivator with 23 participants (74%) rating this as very important or extremely important. Personal outcomes and reducing guilt were generally considered less important as a motivator for food waste reduction, rated very, or extremely, important by only 12 participants. Eleven participants provided additional responses when asked about other outcomes they considered as being very important to them. Some examples of these responses include;

‘Sustainable food chains - sustainable farming practices, community awareness of food waste.’ (Café, Timaru/Oamaru region, no waste monitoring)

‘Just an awareness of the effect we can have on our environment and community. Just a note - I am far far more concerned about plastics waste and landfill issues pertaining to that.’ (Café, Timaru/Oamaru region, no waste monitoring)

‘Simply keeping our business afloat. Our overall food and health philosophy and ethos.’ (Café, Otago region, monitors waste)

‘Customer satisfaction. Every person who enters this business must leave feeling cherished, respected and know that they have been presented with the very best quality of food and presentation possible. We use environmentally friendly cleaning and paper products, free range meats and eggs and try and generate a lot of our own power with a large solar panel system on our roof.’ (Restaurant, Manawatu region, monitors waste)

5.4.5 Participant perceptions and barriers

The questionnaire allowed participants to provide additional thoughts and perceptions about the level and types of food waste generated by their business under the question ‘How do you feel about the current amount of food waste produced by your business and why?’ The researcher also recorded further perceptions and barriers that the convenience sample participants identified in conversations during researcher premise visits.

Most participants stated in general terms they were ‘happy’, ‘felt pretty good’ and were ‘okay’ with the amount of food waste produced. Many perceived their current food waste at an already minimal level, and believed they were making efforts to minimise food waste where possible. For example;

‘I have always been very vigilant and trained staff well. Staff take the muffins home at the end of day. We take food scraps for our chickens. The milk waste from barrister (sic) is reused in baking. As we are a small business food waste costs us money, so we prepare what we need and make more as we sell it so there is not much waste at the end of the day. A few years back we had more wastage so I created a menu that most items were frozen so they weren't sitting there waiting to be sold.’ (Café, Whanganui region, monitors waste)

There were also perceptions that food waste is an unavoidable reality of being in the café and restaurant business, for example;

‘I think our business is a solid and sustainable level of food waste. Food waste is an unavoidable part of cooking unfortunately.’ (Café, Timaru/Oamaru region, no waste monitoring)

Responses received showed a trend towards the perception that businesses were trying hard to minimise food spoilage and food preparation waste, attributing much of their total food waste to customer behaviour and consequent plate waste. This is shown by the following responses;

‘Kitchen produces minimal waste, the main percentage of our food waste comes from customer plate waste - buying large portions over small and then not eating it and throwing away most of it.’ (Café & Restaurant, Southland region, monitors waste)

‘Pretty good as we have bugger all food waste, and we work really hard to minimise all our rubbish and maximise recycling where possible. So we think we're doing really well with minimising our food waste to produce as little as possible and then compost at home what food waste is generated during the day. It would also be really great if our customers didn't waste the food they purchased, or at least take the doggy bag we offer them so they can eat it later rather than it be wasted. But many customers say they don't actually want to take it away for later.’ (Other – ‘Eatery, Otago region, monitors waste)

‘I believe there is too much waste by the customer, this is due to the high level of expectation around what the customer is paying and what they are getting on their plate. If the customer finishes everything on their plate they will often feel they should have got more for their money, they are however happy to not eat it and for it to become waste. Our level of food prep waste can not be minimised

and is at a very low end.’ (Restaurant, Gisborne region, no waste monitoring)

One participant reported now asking each customer if they would like accompaniments, such as butter, rather than serving it as standard practice. However, of the customers who say yes, many will still leave it untouched or only use a very little bit, leaving most on their plate to be wasted.

Some participants described issues related to the growth of different customer preferences and dietary requirements they encountered. A general theme reported was that some customers expected a large range of specialist food items to be available and displayed (e.g. dairy free, gluten free, organic, vegan, raw products), whereas businesses don’t want to be left with large amounts of these left-over (unsold) goods that end up being wasted. This balance between meeting customer expectations and limiting subsequent food waste is shown by the following example;

‘Always the goal is to limit waste in terms of EOD [Edibles on Display] counter waste. However, that has to be balanced with the visual impact on the customer of an empty counter. I am happy most days that we are successful with waste management.’ (Café, Otago region, monitors waste)

One participant reported a barrier to reducing food waste is the growing proportion of their customer base that view consuming unpeeled fruit and vegetables as harmful, due to perceptions that fruit and vegetable skins (e.g. potato, carrot, apple) contain harmful pesticides and chemicals. Subsequently, these customers expect fruit and vegetables used within food items to have been peeled.

Other common reported perceptions and barriers included various difficulties encountered with donating left-overs, or excess food stock, to appropriate food rescue charities (such as Food Share, now known as Kiwi Harvest). This was primarily due to not having enough, or the right type of, food to meet donation criteria, the lack of a food rescue provider in the locality, local council regulations, and liability worries regarding food poisoning and recipients' potential for unsafe food handling. For example;

‘We did use to donate food to Foodbanks but discontinued due to Food-Health procedures.’ (Café, Otago region, no waste monitoring)

While many participants reported allowing staff to eat or take home any unsold/leftover food that cannot be held for sale the next day, two reported giving away appropriate food to people or families in need in their community. This was done despite their perception that it was breaking laws or regulations to do so.

Another reported barrier relates to local council bylaws and regulations pertaining to donating food scraps as animal feed. Some participants report currently doing this practice, while others report that council regulations currently make this an impossibility to do now. Consequently, some participants report taking their food scraps home for their own domestic compost.

5.5 Part two: analysis of measured 24-hour audit data

Researcher-measured audit data provided a one-off point-in-time quantification of actual food waste generation by eleven participating businesses within the wider café and restaurant sector. When collecting food waste upon completion of the audit period, one business reported that the amount of food waste generated was substantially more

than usual as they had spent the day preparing a lot of stocks and sauces, which is not a typical daily occurrence. In contrast, another business reported that the amount of food waste they generated during the audit period was considerably less than what they would typically generate for that day of the week. When questioned about this they were unable to provide any explanation as to why a reduced amount of food waste had been generated.

Figures 19-21 show examples of the food waste generated in each food waste stream by participating businesses, as received by the researcher.



Figure 19. Food waste generated by Business 9 during audit period showing (left to right) customer plate waste, food spoilage waste and food preparation waste



Figure 20. Food waste generated by Business 5 during audit period showing (left to right) food spoilage waste, food preparation waste and customer plate waste



Figure 21. Food waste generated by Business 1 during audit period showing food preparation waste (no food spoilage or customer plate waste was generated).

All businesses served espresso coffee drinks, with many participants reporting giving coffee grinds to customers as a food waste strategy. However, only one included coffee grinds (food preparation waste) in their audit food waste collection. Subsequently, these coffee grinds (4105g) were excluded from data analysis for two primary reasons.

Firstly, to avoid a potential skewing effect on results that inclusion may induce, and

secondly, coffee grinds are considered unavoidable food waste, and therefore are not a primary focus of this research in terms of informing future work related to reducing café and restaurant food waste.

5.5.1 Food waste weights in absolute terms

The results show a considerable range (4g-27529g) in absolute weight of total food waste generated by each business during the audit (Figure 22), occurring both within the total sample and by waste monitoring group. Most businesses (7 of 11) generated around 4-10kgs during the audit period (4020g–10099g), with either food preparation (4 businesses) or customer plate waste (3 businesses) being the dominant contributor to total food waste weight.

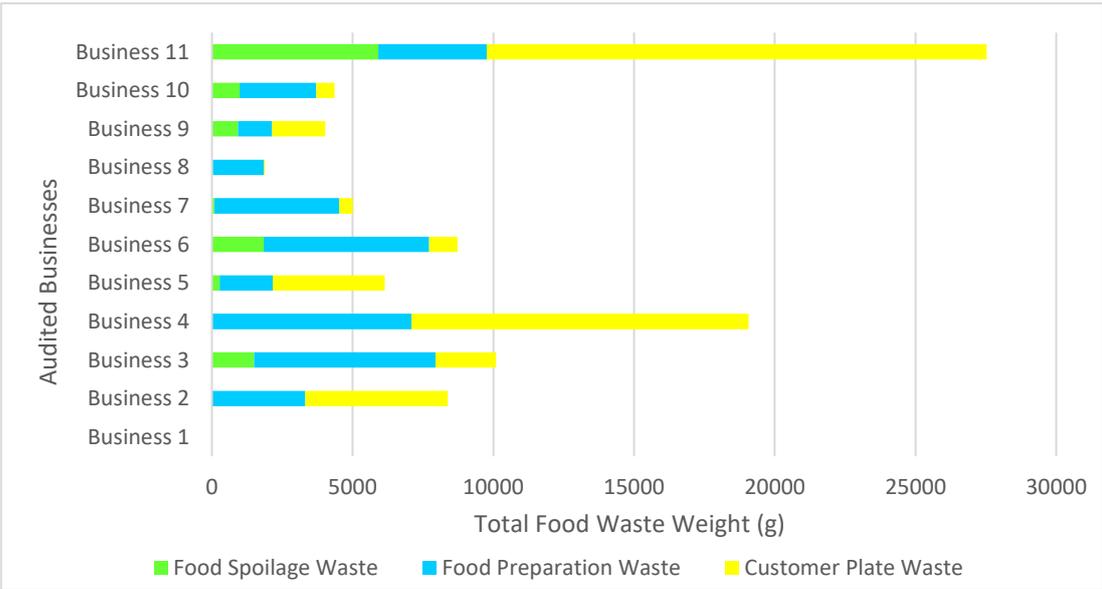


Figure 22. Researcher-measured total food waste weight over a 24-hour period for each audited business, by food waste stream contribution

Two businesses, one from each waste monitoring group, produced considerably higher food waste amounts, at around 19,000g and 27,000g respectively. Customer plate waste was the main contributor to both businesses total food waste generated. At the other end of the spectrum, two businesses produced considerably smaller food waste amounts

than other businesses, weighing in at 4g and 1882g respectively. In both instances, food preparation waste accounted for all, or nearly all, of total food waste.

Additionally, five businesses generated minimal food spoilage waste of less than 100g during the audit, of which three generated no spoilage waste at all. Only one business generated more food spoilage waste than food preparation waste.

When split into comparison groups (Table 5.2), the group undertaking regular monitoring has a smaller mean total food waste weight than the non-monitoring group, and a smaller mean weight for both customer plate waste and food preparation waste. It would have been interesting to determine the significance of these observed differences between groups, had the sample size been large enough to support this.

Table 5.2. Researcher-measured 24-hour food waste weight for each audited business, by food waste generation stream and status of food waste monitoring

	Food Spoilage Waste (g)	Food Preparation Waste (g)	Customer Plate Waste (g)	TOTAL FOOD WASTE (g)
Group 1: No Food waste monitoring				
Business 1	0	4	0	4
Business 2	0	3320	5060	8380
Business 3	1503	6439	2157	10099
Business 4	0	7087	11981	19068
Business 5	275	1889	3977	6141
Mean (SD)	355.6 (652.4)	3747.8 (3002.0)	4635 (4533.2)	8738.4 (6923.1)
Group 2: Food waste monitoring				
Business 6	1840	5876	1011	8727
Business 7	95	4430	481	5006
Business 8	24	1818	40	1882
Business 9	930	1214	1876	4020
Business 10	980	2723	651	4354
Business 11	5913	3852	17764	27529
Mean (SD)	1630.3 (2201.6)	3318.8 (1737.6)	3637.2 (6948.2)	8586.3 (9543.3)
Overall mean (SD)	1050.9 (1742.7)	3513.8 (2272.5)	4090.7 (5712.3)	8655.5 (8044.6)

5.5.2 Mean food waste generation stream results by comparison grouping

When businesses were split by food waste monitoring status, both groups had similar mean total food waste weights (Figure 23), with the absolute difference less than 2% (152.1g) between groups. When analysing the data by mean weight for each food waste stream, much larger differences between the groups can be seen. This is particularly evident for both customer plate waste and food spoilage waste, where the absolute difference between mean group weights for these streams is 998g and 1275g respectively. However, due to the small sample size, the significance for any of these observed differences could not be determined.



Figure 23. Mean weight each food waste stream contributes to total food waste weight, by whether regular food waste monitoring occurs

Analysing the same group data by mean percentage values (Figure 24) shows the composition of each food waste stream within the relative 100% value of each groups total food waste. As with mean weight values (Figure 23), the same trend can be seen for both groups, with the largest percentage contribution to total food waste coming from customer plate waste and the smallest from food spoilage waste.

However, the food waste monitoring group has a much smaller range (23.3%) between the smallest and largest mean percentage contributions (compared to 48.9%), with total food waste being more evenly generated among each food waste stream. As with other data analysis already mentioned, the significance of these observed differences cannot be determined.

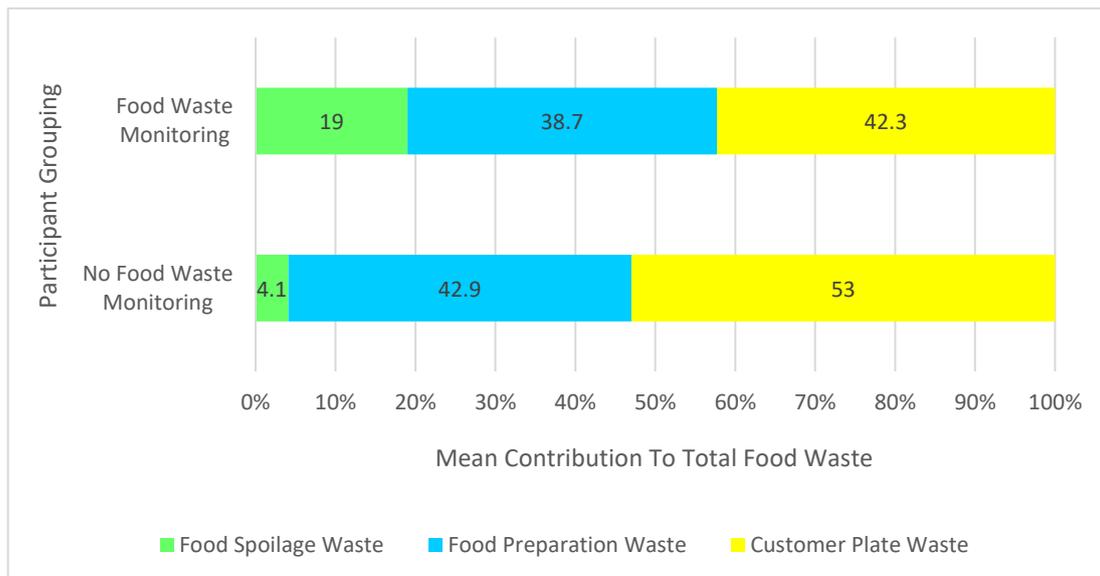


Figure 24. Mean percentage contribution of each food waste stream, by whether regular food waste monitoring occurs

5.5.3 Avoidable food waste results by food type grouping

Numerous absolute weight values were recorded by the researcher for each business' food waste generated during the audit period. Table 5.3 shows the total weight of each business' food waste generated within each separate food type group, along with the calculated percentages considered to be avoidable and both avoidable and potentially avoidable combined. These results show considerable variation exists, both between businesses and between food type groups, in terms of food waste generated.

However, some potential trends can be identified, such as that of the businesses that generated 'Cereals & Grains' food waste, 100% was found to be avoidable food waste.

Of the businesses that generated 'Bakery', 'Potatoes' and 'Legumes, Nuts & Seeds' food waste, 100 percent was found to be either avoidable or potentially avoidable, while more than 80% of all 'Dairy' food waste was avoidable.

Table 5.3. Researcher-measured 24-hour food waste weight and proportion considered to be avoidable for each food type grouping, by individual business and food waste monitoring status

		FOOD TYPE GROUPINGS#											
		Fruit	Vegetables	Potatoes	Meat	Fish	Dairy	Eggs	Bakery	Cereals & Grains	Legumes, Nuts & Seeds	Miscellaneous Food Waste	Unidentified Food Waste
NO FOOD WASTE MONITORING													
Business 1	TW (g)*	0	4	0	0	0	0	0	0	0	0	0	0
	% A‡	0	100	0	0	0	0	0	0	0	0	0	0
	% A-PA†	0	100	0	0	0	0	0	0	0	0	0	0
Business 2	TW (g)	164	1649	2065	785	44	144	561	2420	186	0	142	164
	% A	48.6	58.8	100	92.7	100	100	58.6	100	100	0	100	100
	% A-PA	90	97.5	100	100	100	100	58.6	100	100	0	100	100
Business 3	TW (g)	490	192	227	98	0	69	499	8076	112	0	128	146
	% A	98.4	95.8	100	86.7	0	100	6.6	98.8	100	0	22.7	100
	% A-PA	98.4	95.8	100	100	0	100	6.6	100	100	0	22.7	100
Business 4	TW (g)	752	10117	286	1606	0	0	68	2335	3146	476	282	752
	% A	0	42.2	100	93.3	0	0	0	100	100	100	100	100
	% A-PA	0	85	100	97.7	0	0	0	100	100	100	100	100
Business 5	TW (g)	16	1999	768	1199	681	135	20	591	268	46	76	16
	% A	12.2	54.2	100	53.5	55.9	82.2	0	94.9	100	100	100	100
	% A-PA	94.8	95.5	100	66	69.6	82.2	0	100	100	100	100	100
MEAN (SD)	TW (g)	284 (327)	2792 (4187)	669 (829)	737 (693)	145 (300)	70 (70)	229 (276)	2684 (3196)	742 (1347)	104 (209)	125 (104)	215 (309)
	% A	32 (42)	70 (26)	80 (45)	65 (40)	3 (45)	56 (52)	13 (26)	79 (44)	80 (45)	40 (55)	65 (49)	80 (45)

FOOD TYPE GROUPINGS#													
		Fruit	Vegetables	Potatoes	Meat	Fish	Dairy	Eggs	Bakery	Cereals & Grains	Legumes, Nuts & Seeds	Miscellaneous Food Waste	Unidentified Food Waste
	% A-PA	57 (52)	95 (6)	80 (45)	73 (43)	34 (48)	56 (52)	13 (26)	80 (45)	80 (45)	40 (55)	65 (49)	80 (45)
FOOD WASTE MONITORING													
Business 6	TW (g)	197	3128	497	80	42	204	428	3199	42	16	365	197
	% A	85.2	20.1	30.8	100	61.9	100	0	81.2	100	100	10.4	100
	% A-PA	94.5	71.5	100	100	100	100	0	100	100	100	10.4	100
Business 7	TW (g)	5	3027	306	0	0	64	142	494	0	8	8	5
	% A	24.5	27.7	0	0	0	100	0	100	0	50	0	100
	% A-PA	83.4	71.9	100	0	0	100	0	100	0	100	0	100
Business 8	TW (g)	0	383	0	499	0	18	357	159	43	2	11	0
	%	0	20.6	0	0	0	100	0	100	100	100	90.9	0
	% A-PA	42.1	69.5	0	61.3	0	100	0	100	100	100	90.9	0
Business 9	TW (g)	107	1435	40	36	94	157	363	591	257	341	35	107
	% A	46.4	97.5	100	100	100	100	35.3	85.8	100	100	0	100
	% A-PA	46.4	97.5	100	100	100	100	35.3	100	100	100	0	100
Business 10	TW (g)	980	1400	0	152	0	177	393	874	276	20	52	980
	% A	25.6	26.9	0	0	0	100	3.1	100	100	100	0	100
	% A-PA	25.6	73.8	0	100	0	100	3.1	100	100	100	0	100
Business 11	TW (g)	5272	4474	5107	2205	711	159	897	3168	757	37	297	5272
	% A	73.9	83	91.3	70.5	60.6	81.1	100	100	100	100	52.5	100
	% A-PA	87.7	96.9	100	79	65.4	81.1	100	100	100	100	52.5	100
MEAN (SD)	TW (g)	1094 (2080)	2308 (1495)	992 (2026)	495 (867)	141 (282)	130 (72)	430 (250)	1415 (1389)	229 (284)	71 (133)	128 (160)	1094 (2080)

FOOD TYPE GROUPINGS#													
		Fruit	Vegetables	Potatoes	Meat	Fish	Dairy	Eggs	Bakery	Cereals & Grains	Legumes, Nuts & Seeds	Miscellaneous Food Waste	Unidentified Food Waste
	% A	43 (32)	46 (35)	37 (47)	45 (51)	37 (43)	97 (8)	23 (40)	95 (9)	83 (41)	92 (20)	26 (38)	83 (41)
	% A-PA	63 (29)	80 (13)	67 (52)	73 (39)	44 (50)	97 (8)	23 (40)	100 (0)	83 (41)	100 (0)	26 (38)	83 (41)
OVERALL COMBINED SAMPLE													
MEAN (SD)	TW (g)	726 (1554)	2528 (2862)	845 (1535)	605 (758)	143 (275)	102 (75)	339 (270)	1991 (2343)	462 (916)	86 (163)	127 (130)	694 (1553)
	% A	38 (36)	57 (32)	57 (49)	54 (45)	34 (42)	78 (39)	19 (33)	87 (30)	82 (40)	68 (46)	43 (46)	82 (40)
	% A-PA	60 (39)	87 (13)	73 (47)	73 (39)	40 (47)	78 (39)	19 (33)	91 (30)	82 (40)	73 (47)	43 (46)	82 (40)

* TW (g) = Total Weight (in grams) ‡ % A = Percent considered Avoidable † % A-PA – Percent considered Avoidable and Potentially Avoidable combined

Packaged Liquids has not been included in the Food Type Groupings shown in this table as no businesses food waste contained any items in this grouping

Contrastingly, of the businesses that generated 'Eggs' food waste, the majority had very low proportions considered to be both avoidable and potentially avoidable. Other key findings show that 'Vegetables' was the sole food type that had an amount of food waste generated by every business. Additionally, 'Vegetables' was the food type with the largest mean total weight when calculated for all businesses combined, as well as for both groups when split by food monitoring status.

5.5.4 Comparison of matched questionnaire and audit data

Matching audit data with the corresponding questionnaire data for each business (Figure 25) shows considerable variation in the food waste generation composition for nearly all businesses (9 of 11). This was generally more so for both customer plate waste and food preparation waste streams than for food spoilage.

The questionnaire and audit data were relatively similar for two businesses. Results for 'Business 3' showed differences in contributions for each food waste stream were less than 10%, while results for 'Business 2' showed identical customer plate waste contributions, and both food spoilage and food preparation contributions within 10% of each other.

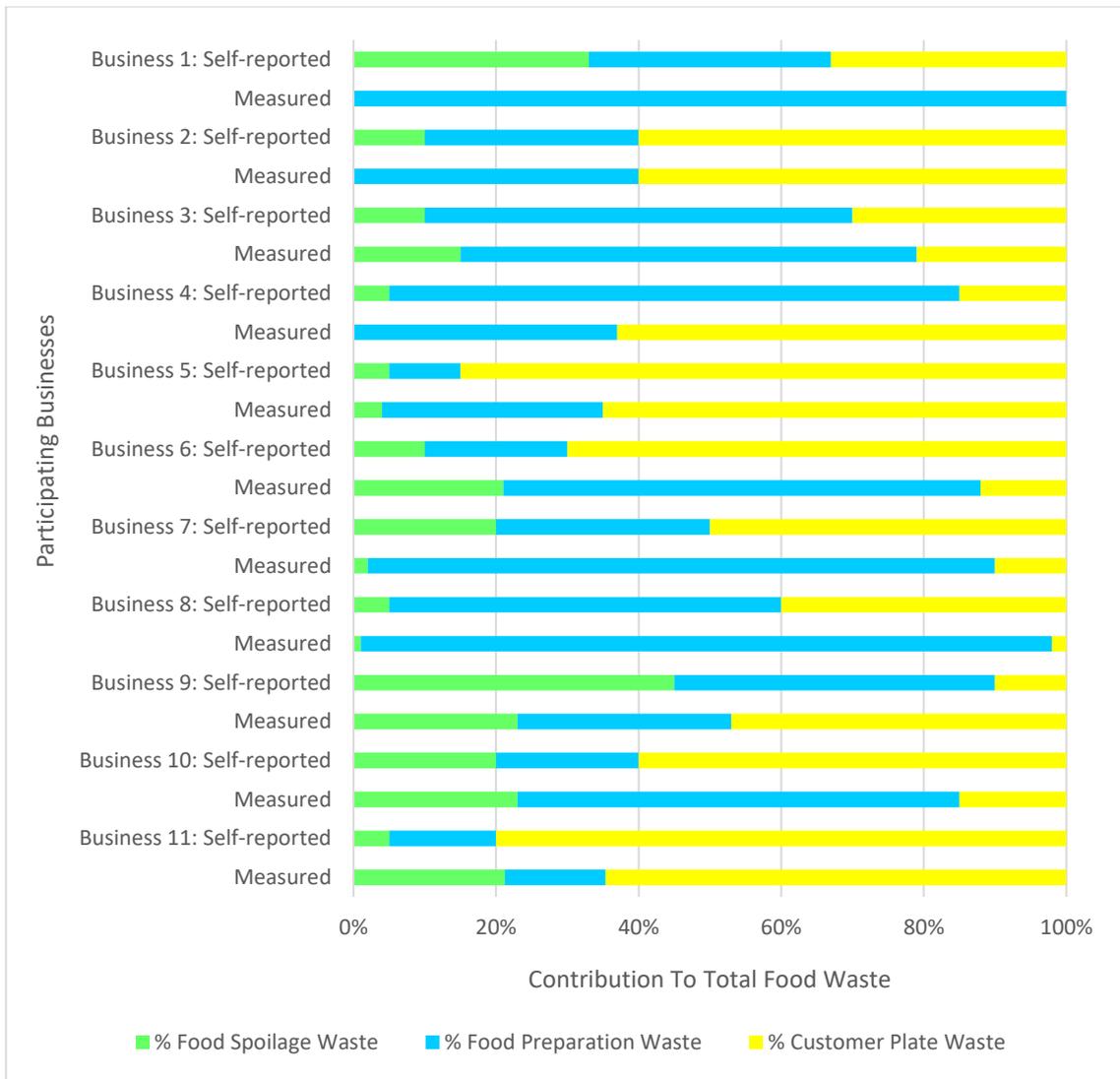


Figure 25. Self-reported and researcher-measured contribution of each food waste stream to total food waste generation, by individual business

Matching questionnaire and audit data for each business (Figure 26) shows a difference for every participant between their self-reported percentage band of total food waste that they considered to be avoidable, and the corresponding audit quantified amount. While every participant self-reported avoidable food waste as less than 20%, audit data shows avoidable proportions as 21%-100% of each business' total food waste. For most businesses (8 of 11), measured avoidable food waste was found to be in the two highest percentage bands, comprising 60% or more of total food waste.

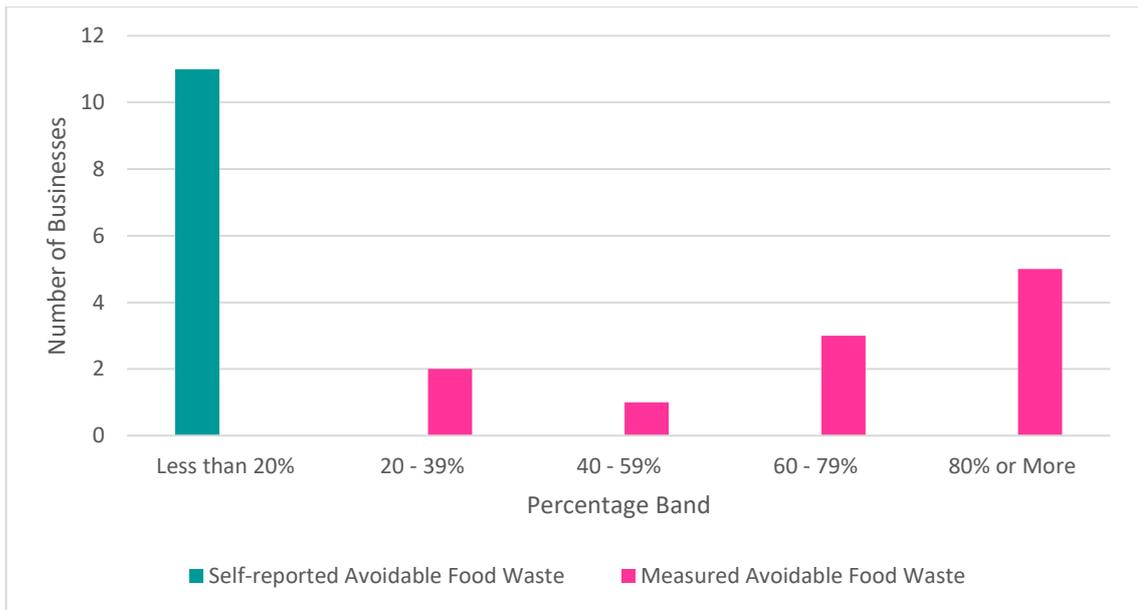


Figure 26. Self-reported and researcher-measured avoidable food waste as a percentage band amount of total food waste for each business

5.6 Summary of key findings

Table 5.4 shows a summary of the findings that have been detailed throughout Section 5.0. These summarised findings have been categorised using concepts related to the main objectives of this research, with key results identified within each category.

Implications of key findings are detailed in Section 6.0.

Table 5.4. Summary of key findings

KEY OBJECTIVE CONCEPT	KEY FINDINGS OF NEW ZEALAND CAFÉ AND RESTAURANT SAMPLE
Total food waste generated	All reported total food waste as less than 40% of total business waste generated; most reported food waste to be under 20%. Quantified daily food waste generation ranged between 4g-27529g; most generated around 4kg-10kg.
Preventable food waste generated (avoidable)	Most reported the amount of avoidable food waste as less than 20% of total food waste. Quantified avoidable food waste generation ranged between 21%-100%; nearly all generated more than 50%.
Where food waste occurs	Variation occurred in reported waste stream contributions; mean reported totals show food preparation waste and customer plate waste as equally dominant generation streams. Quantified food waste mean totals show customer plate waste as the dominant generation stream.
Types of foods wasted	Reported foods commonly wasted featured vegetables, accompaniments and lower-value carbohydrates/bakery items. Vegetables featured in all audited food waste collections.
Participant food waste perceptions	Customer behaviour and consequent plate waste are perceived as being key contributor to food waste. Trend for some potential food waste reduction strategies to be perceived as easy to implement with high level of impact. Financial and environment outcomes are important motivators for reducing food waste. Food waste generation often perceived as minimal; participants generally comfortable with amount of food waste generated.
Quantified and self-reported comparisons	All self-reported amounts of avoidable food waste generation were less than amounts quantified by 24-hour audit. Reported food waste generation stream contributions were mostly inconsistent with quantified audit waste stream contributions.

6.0 DISCUSSION AND CONCLUSION

This research provides a useful insight into current food waste practices for a sample of New Zealand cafés and restaurants, establishing baseline sector knowledge for future research. Most participants reported their food waste as less than 20% of total waste, with most generating 4kg-10kg daily. Nevertheless, a high proportion was avoidable. Most businesses' actual avoidable food waste contributed more than 50%, while all self-reported avoidable food waste amounts were less than the matching audit quantified amount. Customer plate waste and preparation waste were the dominant waste streams, with vegetables, accompaniments and lower-value carbohydrates featuring highly among commonly wasted food types cited. Food waste generation was generally perceived as minimal and participants were comfortable with how much food waste their business generated. Moreover, most participants reported both financial and environmental outcomes as important motivators for reducing food waste.

6.1 Food waste: amounts, types and where it occurs

Variance in reported measures for quantifying food waste (2, 13, 15, 31), and lack of a universal agreement of hospitality food waste generation (13), makes it difficult to compare figures between studies. The present results show some similarity with overseas findings for restaurants (12, 17), but no similarity with an Auckland-specific report stating a much higher proportion of food waste (47). This outcome is not surprising given existing research inconsistencies. While these present results have a limited international contribution due to sample size, they primarily serve as a starting point within the New Zealand context. Additionally, these results may also be a marker of progress within New Zealand over the last 15 years, showing cafés and restaurants

are responding to the growing awareness of sustainability issues within the sector (47). However, caution must be taken with interpretation of self-reported data.

The café and restaurant sector is very diverse (13), so the wide range of total food waste weights found in this research was expected. Context is essential for interpretation, as factors like daily covers (full meal or take-out coffee), meal size and service styles undoubtedly influences food waste generation. For example, the highest food waste generator in this study served 300 plus daily covers, offered all meal types, and provided al a carte, room service, buffet and out-catering services. The smallest generator, however, had a small menu based on take-away snacks and was owner-operated in line with their sustainability beliefs. This demonstrates the need to look beyond the initial face-value of reported food waste weights when attempting to compare studies and to gauge applicability. For example, the average daily food waste weight per business in this study (8.7kg) should not be compared with reported international findings (59.8kg and 173kg) (19, 33) without first accounting for differences in participant characteristics. Generalisations can misrepresent findings.

Avoidable food waste is an important issue, so it is a concern that a difference between self-reported and audit quantified food waste amounts existed for each business (self-reported: <20% of total food waste; audited: >50% of total food waste). Given audit findings align with previous research (17, 23, 24, 33), a combination of factors may contribute to the consistent difference observed when compared to self-reported totals; for example, participants may have limited understanding of what constitutes avoidable food waste, or be unwilling to acknowledge the quantity generated (or associated implications), or their current food waste monitoring practices are not fit for purpose to accurately gauge avoidable waste. Also, a single audit may not reflect typical amounts.

In this New Zealand sample, customer plate waste and food preparation were the dominant waste streams and food spoilage was minor in comparison. Audit results identified customer plate waste as the largest stream, which aligns with a Swedish study (12) and observations from a New Zealand study (52), but contradicts British findings that identified food preparation waste as the dominant stream (16, 17, 19). Regardless, food spoilage is consistently recognised as a smaller waste generator (12, 16, 17, 19). Research context may explain these study differences. The hospitality sector in New Zealand has acknowledged the growing importance of sustainable food practices (48), so businesses may be more conscious of waste streams they can directly control, such as reducing preparation and spoilage waste. This was seen in the Swedish study (12).

Foodservice operations are also influenced by external environmental factors (55), including prevailing social conditions that influence customer behaviour. This is seen in the value customers place on café and restaurant food they purchase and the ease at which uneaten food is left on their plate. For example, one business in a strong farming region, reported customers expect value for money and large hearty portions regardless of hunger. The competitive nature of the New Zealand café and restaurant sector means customer satisfaction is an essential and relevant outcome businesses cannot ignore. Additionally, businesses may have an unconscious tendency to implicate customers rather than themselves for food waste generation; if they cannot control it, then it may be disregarded. Furthermore, plate waste may not affect financial performance, given the customer has already paid for this food (12, 15).

Participating businesses were aware of commonly wasted food types for both spoilage and preparation food waste streams, predominantly citing vegetable and bakery waste. Starches and vegetables, often served as side dishes and accompaniments, are perceived as lower-value food types and contribute significantly to food waste (12, 14, 15, 24).

Vegetables (peelings and skins) featured in every audit undertaken, which is expected given New Zealand cafés and restaurants commonly feature vegetables in the menu. As peelings and skins are often deemed unavoidable wastage in foodservice (17, 24), there may be more openness in reporting it, and more awareness due to their regular occurrence. Additionally, the limited storage life of fresh produce means vegetables are vulnerable to spoiling more quickly than dry or frozen goods.

In terms of customer plate waste, trends mirror previous research (12, 17), whereby lower-value food types feature strongly, especially low-value carbohydrate foods such as potato-based products, pasta and rice (also in salads), bread and bakery items. These foods also tend to be relatively cheap, meaning they may be ordered more often and served in larger portions to make customers feel full, and hence, satisfied by their meal.

6.2 Food waste perceptions

Staff hold a range of perceptions regarding potential food waste reduction strategies. Given the diverse characteristics of cafés and restaurants (13), this is expected, as strategies that align well with one business may not suit another. Therefore, it is heartening to see an overlap where some proportionately rated high-impact strategies are also rated by many participants as easy to implement. These strategies may be considered more generic and mainstream, and thus more applicable to a broad range of businesses. Furthermore, this creates a potential starting point from which to engage with cafés and restaurants to undertake sector-wide food waste reduction strategies. However, an important consideration is that many participants report feeling comfortable with their current food waste generation and practices, perceiving the amount generated as minimal. This could potentially extrapolate as an overall reduced inclination for further food waste initiatives, especially if perceived as unnecessary or

too burdensome. This current comfort regarding food waste could also link to their perceptions of customer behaviour as the main contributor. Furthermore, this opens opportunities to develop effective strategies targeting the drivers of customer behaviour, echoing previous findings (9, 12, 15), and potentially being embraced by the sector as less judgemental and critical of their business operations.

6.3 Strengths and limitations

The primary focus of this research on food waste generation and area of occurrence, rather than disposal and management, is viewed as a strength, as it can help to inform future food waste reduction strategies, aligning with principles of the Food Waste Hierarchy (25). This research also begins to address an important knowledge gap in the New Zealand context, to establish initial quantitative and qualitative knowledge for the café and restaurant sector. Furthermore, the use of recommended weight-based quantification (3, 13) allows further research to build on this work in line with current best practice. Additionally, research was undertaken in an independent and objective manner with no links to the sector or food waste organisations.

Randomised participant recruitment was challenging (described in Section 4.0), with low response rates making generalisation and extrapolation of findings difficult, but is similar to other researchers' experiences (9, 14, 15, 24). Additionally, the small sample sizes in this research meant further statistical testing was inappropriate due to potential for misleading values. The use of convenience sampling introduced both selection and response bias (57), as participants may be more food waste-conscious, potentially using more waste reduction practices that results in smaller average food waste totals.

However, this method proved successful for increasing participation rates and breadth of data collected. Lastly, a single audit provides a snap-shot of food waste at a single

time-point, and as acknowledged in literature (19), does not address normal daily, weekly and seasonal fluctuations. However, the use of questionnaire results reporting perceived usual food waste in this research may partly counter this by translating fluctuations into a typical amount.

6.4 Conclusion and future recommendations

The café and restaurant sector appears to be a significant contributor to food waste generation in New Zealand, creating a greater upstream ecological impact than earlier in the FSC (12, 23, 24). Avoidable food waste is the principle concern yet participating businesses self-reported amounts consistently different from 24-hour audit amounts, and may be unaware of the full opportunity to reduce food waste. As noted in the literature (3, 4, 11, 13, 53), success will be limited unless the magnitude, location and causes are known, and, a targeted action plan is established.

To help businesses successfully reduce food waste, it is recommended the sector becomes familiar with the ‘SDG Target 12.3 strategy’ (5, 10, 11) addressing global consumption food waste. This strategy outlines three steps for food waste reduction, namely ‘Target’, ‘Measure’, and ‘Act’, and can provide guidance to the sector to both advocate for, and inform, the development of future food waste reduction efforts.

Firstly, setting specific reduction targets creates drive and ambition, which ultimately creates motivation for action. Secondly, measuring and classifying food waste can help managers understand the problem and prioritise initiatives for action. Lastly, taking action is essential to achieve real change (5, 11). In terms of strategy communication to the café and restaurant sector, it could be likened to a familiar concept like financial performance, as businesses routinely set financial targets, measure current performance, and regularly undertake actions to monitor financial outcomes.

The recognition of financial outcomes as an important motivator is not new as profitability is essential to business success. Interestingly, a business case produced by the Target 12.3 Strategy found for every \$1 an FSC end stage business invests in reducing food waste, they receive a \$14 financial return. Furthermore, restaurants were identified as receiving the highest financial returns (5). The importance of environmental outcomes as another motivator reflects the increasing acknowledgment of multifaceted sustainable business practices within the sector (48). Therefore, it is recommended future food waste research explores developing regional and national food waste reduction campaigns and initiatives, aligned with Target 12.3, that tap into both financial and environmental motives. Moreover, given the complexities of customer behaviours, and perceptions of customers as key food waste contributors, these motives could underpin consumer education initiatives specifically targeting customer plate waste behaviour.

For future research, adequate time to approach and collaborate with sector organisations and associations to recruit participants would be useful. Research participation promoted via a national representative body may provide extra credibility, and overcome limited rapport building, in this very time-poor, high-pressure sector, which may help to address low response rates. Additionally, this may be an avenue for promoting the economic benefits of food waste awareness and effective monitoring and management processes. The development of consistent design and comparison methodology protocols for this area of research are also recommended, to establish a sound base from which future research can build on and expand with more resources.

While this research suggests New Zealand cafés and restaurants are a significant sector regarding the issue of food waste, their potential role in food waste reduction needs to be viewed as only one part of a greater collective effort to reduce overall food waste.

7.0 APPLICATION TO DIETETIC PRACTICE

This mixed methods research provided useful insights into the food waste problem in participating New Zealand cafés and restaurants. Every business self-reported a different amount of avoidable food waste generated in their daily operations compared to the amount measured by a 24-hour audit collection. All self-reported amounts were less than measured amounts, and businesses perceived most avoidable food waste was due to customer behaviours and plate waste. Nevertheless, participating businesses reported that both financial and environmental outcomes would be important motivators for reducing food waste.

Sustainability and environmentally aware practices, of which food waste is an inherent aspect, are gaining recognition as important issues within dietetic practice (58, 59). In the New Zealand context, dietetic competency requirements outline the dietitian's ability to support optimal population health and well-being in a variety of settings, including managing food systems, within the context of economic, social and cultural conditions (60). Therefore, dietitians are positioned to advocate for, and develop, programmes and initiatives that enable populations secure access to safe, diverse and nutritious food. Food security cannot be achieved if local food environments and supply systems lack resilience and are not sustainable, and if these influences on individual and group food consumption habits are not acknowledged.

Dietitians with foodservice management roles within the wider foodservice industry are uniquely positioned to apply these insights, and to explore issues pertaining to food waste generation within foodservice operations. Awareness of avoidable food waste and customer plate waste, combined with dietetic knowledge of the foodservice

systems model (55), enables dietitians to collaboratively develop and implement targeted food waste reduction strategies with an understanding of the potential impact across all system areas, such as customer satisfaction, procurement processes, and human resources. Furthermore, dietitians can tap into environmental and financial benefits to justify implementing new food waste initiatives within the management of foodservice operations. They can develop systems to provide sustainable nutritious food and environmentally sound food waste practices, whilst meeting financial objectives.

In this research, differences were seen between self-reported and 24-hour audited amounts and types of food waste, as well as the reported absence of food waste monitoring by some businesses. This suggests potential opportunities exist for dietetic input specifically within the hospitality café and restaurant sector to implement and improve foodservice management tools. Given that dietetic postgraduate training programmes incorporate foodservice management learning and assessment requirements, there is potential for incorporating a foodservice placement set within the hospitality café and restaurant sector alongside the current placement experiences in health care and educational based settings. This would serve to establish a potential relationship and encourage dialogue and understanding between this significant hospitality sector and the dietetic profession. This would also create potential for broadening the scope of learning and knowledge that future dietitians have regarding food supply, operation and management, including effective food waste management practices.

On a personal level, dietitians can also apply these research insights to their day-to-day habits, role-modelling sustainable consumption habits for family and friends. They can consider the portion sizes and amount of food ordered when eating at cafés and

restaurants, actively request to take home uneaten leftovers, and support and encourage businesses trying sustainable practices by ordering food or dishes utilising meat/plant-based off-cuts traditionally considered to be less desirable.

Finally, dietitians can undertake professional development opportunities to increase their knowledge and skills relating to sustainable food practices and food waste reduction. This training would further enable dietitians to contribute collaboratively within a multi-disciplinary setting to help shape public policy across multiple levels, guide foodservice industry efforts, and influence social responsibility practices.

Employing a long-term view, all of these elements can eventually create a level of momentum regarding food waste reduction strategies, whereby the flow-on effect serves to positively impact on café and restaurant food waste generation in New Zealand.

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APPENDICES

Appendix A: Ethical Approval Documents

University of Otago Human Nutrition Department Ethical Approval

Reporting Sheet for use ONLY for proposals considered at departmental level

cc LM,
Sent to Ethics
17/7/17



Form Updated: September 2016

UNIVERSITY OF OTAGO HUMAN ETHICS COMMITTEE APPLICATION FORM: CATEGORY B

(Departmental Approval)

1. University of Otago staff member responsible for project: Dr. Louise Mainvil
2. Department: Human Nutrition
3. Contact details of staff member responsible: louise.mainvil@otago.ac.nz
4. Title of project: *Supporting the New Zealand Restaurant and Café Food Service Sector to Reduce Food Waste*
5. Indicate type of project and names of other investigators and students:

Staff Research	<input checked="" type="checkbox"/>	Names	Dr. Miranda Miroso (Food Science)
Student Research	<input checked="" type="checkbox"/>	Names	Sarah Chisnall (Human Nutrition) Emily Jones (Human Nutrition)
<i>Level of Study</i>			Master of Dietetics
6. When will recruitment and data collection commence? 14th July 2017
When will data collection be completed? 30th November 2017

7. Brief description in lay terms of the aim of the project, and research questions:

Food waste has been assessed in domestic and non-hospitality foodservice sectors within New Zealand. This study aims to quantify food waste in the hospitality foodservice sector. This investigation will assess the amount and types of food waste being produced in restaurants and cafés throughout New Zealand. Selected businesses will be asked to complete a questionnaire to quantify and describe their usual daily food waste, to explain current food waste policies and practices, and to comment on proposed food waste strategies and motives for change. Subsequently, a subset of 30 businesses will be randomly selected to participate in a food waste audit. Three bins will be provided to the business and collected after a 24-hour period in order to quantify food waste from spoilage, preparation, and consumer plates.

8. Brief description of the method:

Part 1: Food Waste Questionnaire

Participant selection and consent

A simple random sample of 500 New Zealand café/restaurants will be drawn from the sampling frame of all 'Cafe' and 'Restaurant' listings in New Zealand *Yellow Pages* directories. Each student researcher will be responsible for contacting 250 selected businesses, initially by telephone and then by phone and/or email, inviting them to complete a food waste questionnaire. A 30% response rate is expected (N=150 participants in total). To maximise response rates, participants will be offered the opportunity to be included in a prize draw for one of four *Prezzie* cards worth \$50 each.

The initial phone *call* will aim to establish: whether the business is an operational café/restaurant, the appropriate person(s) to participate and their willingness to do so, and contact details (email, phone). Interested participants can choose to either: (i) undertake the survey verbally at that time, (ii) undertake the survey verbally at a nominated time convenient to them, or (iii) be emailed a link to the online questionnaire for completion within an agreed timeframe. Prior to data collection, informed consent will be obtained. Interested parties choosing options (i) and (ii) will be read the Information Sheet and Consent Form (Appendix A) and verbal consent will be sought (and recorded). Those choosing option (iii) will be emailed the Info. Sheet and Consent Form and written consent will be requested. In all cases, questionnaire completion will indicate consent to participate.

Questionnaire data collection

Participants will be asked to spend approximately 30 minutes answering a series of questions either verbally or in self-administered online questionnaire format. During telephone surveys, the researcher will record verbal responses in written and audio formats (wherever possible) to ensure data accuracy and completeness. The researcher will prompt participants to elaborate on their responses where appropriate.

The 24-item questionnaire (Appendix B) is based on the WRAP Telephone Hospitality Survey⁴. Alterations were made for the New Zealand context and project scope. Selected businesses will be asked to quantify and describe their usual daily food waste, to explain current food waste policies and practices, and to comment on proposed food waste strategies and motives for change. Business characteristics will also be documented. Questionnaires will be labelled with a unique identifier, so researchers can contact non-respondents (send up to 3 reminders) and a sub-group of participants for Part 2 of the study, and link Part 1 and Part 2 data.

⁴ Partil J, Eatherley D, Hawkins R, Prowse G. Appendix B: Telephone survey questionnaire. In: Waste in the UK hospitality and food service sector – full technical report. UK: WRAP; 2013.

Part 2: Waste Audit

Participant selection and consent

Thirty businesses (selected from Part 1 participants willing to participate in a waste audit) will be invited via phone and/or email to have their waste audited over a 24-hour period. Purposive sampling will be used to recruit a range of restaurants and cafés, based on quantity of self-reported food waste (high, medium, low) and location (limited to main centres: Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin). Financial, geographical and logistical constraints may impact on selection. Participants will give written informed consent prior to the audit (Appendix C).

Waste audit data collection

The researcher will provide each business with three bins and instructions for the 24-hour audit. During this 24-hour period, businesses will be asked to separate all food waste into three categories: kitchen spoilage, kitchen preparation, and consumer plate waste.

At the end of the 24-hour period, the researcher will collect the bins, check that waste was disposed in the correct bin, and weigh the total waste in each bin. Attempts will be made to categorise and weigh the contents of each bin (e.g. fruit, vegetables, meat, bakery, etc.). After the waste is processed, it will be disposed of at the restaurant/café site using their procedures. Waste audit data will be labelled with the participant's unique identifier, so it can be linked to Part 1 data.

Data management (Parts 1 and 2)

All information collected will be securely stored in such a way that only the researchers named on this application will be able to gain access to it. At the end of the project, any personally identifying information will be destroyed immediately (i.e. contact lists with unique identifiers, audio-recordings, emails). Raw data on which the results of the project depend (i.e. signed consent forms, completed questionnaires and relevant comments, audit data) will be retained in secure storage (i.e. password-protected electronic files, or in a locked filing cabinet) in Dr. Miross's University of Otago office until it is no longer needed, after which it will be securely destroyed. Dr. Mainvil will be responsible for the safe destruction of personal information and storage of raw data.

9. Disclose and discuss any potential problems and how they will be managed:

To manage health and safety risks when handling food waste, researchers will use protective equipment (e.g. tarps), clothing (including gloves) and eyewear at all times. Care will be taken to avoid spillage if transport is required.

Every attempt will be made to not disclose the names of participating businesses to anyone outside the research team. Names will not be published, unless this is specifically requested by businesses.

Applicant's Signature: Loise Mainvil

Name (please print): Loise Mainvil

Date: 13/7/17

Reporting Sheet for use ONLY for proposals considered at departmental level

ACTION TAKEN

Approved by HOD

Approved by Departmental Ethics Committee

Referred to UO Human Ethics Committee

Signature of Head of Department: 

Name of HOD (please print): S. Samman

Date: 2/7/12

Departmental approval: *I have read this application and believe it to be valid research and ethically sound. I approve the research design. The research proposed in this application is compatible with the University of Otago policies and I give my approval and consent for the application to be forwarded to the University of Otago Human Ethics Committee (to be reported to the next meeting).*

IMPORTANT NOTE: As soon as this proposal has been considered and approved at departmental level, the completed form, together with copies of any Information Sheet, Consent Form, and survey or questionnaire should be forwarded to the Manager, Academic Committees or the Academic Committees Administrator, Academic Committees, Rooms G22, or G26, Ground Floor, Clocktower Building, or scanned and emailed to either gary.witte@otago.ac.nz, or jane.hinkley@otago.ac.nz

University of Otago Human Ethics Committee Approval



D17/241

Academic Services
Manager, Academic Committees, Mr Gary Witte

7 August 2017

Dr L Mainvil
Department of Human Nutrition
Division of Sciences

Dear Dr Mainvil,

I am writing to confirm for you the status of your proposal entitled "**Supporting the New Zealand Restaurant and Cafe Food Service Sector to Reduce Food Waste**", which was originally received on July 27, 2017. The Human Ethics Committee's reference number for this proposal is D17/241.

The above application was Category B and had therefore been considered within the Department or School. The outcome was subsequently reviewed by the University of Otago Human Ethics Committee. The outcome of that consideration was that the proposal was approved.

Approval is for up to three years from the date of HOD approval. If this project has not been completed within three years of this date, re-approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

Yours sincerely,

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8258
Email: gary.witte@otago.ac.nz

Appendix B: Participant Consent Form Documents

Part One: Food Waste Questionnaire Consent Form

Reference Number: **D17/241**

July 2017



Supporting New Zealand Restaurants and Cafés to Reduce Food Waste **INFORMATION SHEET FOR PARTICIPANTS**

Thank you for your interest in this project. Please read this information before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

Project Aim and Purpose

Reducing food waste can save businesses money and help the planet, so we want to find out:

- the level and types of food waste from ~200 restaurants and/or cafés throughout New Zealand, and
- learn what businesses are doing to limit food spoilage, preparation waste, and consumer plate waste.

This project will enable Sarah Chisnall and Emily Jones to complete their Master of Dietetics degree.

Participant expectations

We are asking New Zealand businesses, who are listed as a 'Cafe' or 'Restaurant' in the *Yellow Pages*, to answer ~20 questions over the phone, or via an online questionnaire, taking no more than 20-30 minutes.

The Dept. of Human Nutrition, who is funding this research, has approved the main questions (eg. estimate the amount and type of food waste in your café/restaurant, your thoughts about it, what your business is doing to reduce it), but some new questions may arise during a telephone call. You can choose to answer a question or not. Telephone interviews will be audio-recorded to save time; you can ask for the device to be turned off at any time. After the call, responses will be typed (excluding identifying information) and the audio-recording destroyed.

All information collected during this project will be treated *confidentially*. Only the people listed below will have access to your responses. After the project, identifying information will be destroyed. Dr Mainvil and Dr Mirosa will safely store your information at the University of Otago for at least 5 years. Project results will be published and made available from the University of Otago Library or us; every attempt will be made to preserve your *anonymity* (for you and your business) in any publications.

Can participants change their mind and withdraw from the project?

Taking part in this activity is voluntary. You may withdraw at any time with no disadvantage.

If you have any questions about our project, either now or in the future, please feel free to contact either:

- Sarah Chisnall* (Email: chisa097@student.otago.ac.nz)
 - Emily Jones* (Email: jonem185@student.otago.ac.nz)
 - Dr. Miranda Mirosa^ (Email: miranda.mirosa@otago.ac.nz)
 - Dr. Louise Mainvil* (Email: louise.mainvil@otago.ac.nz)
- * Dept. of Human Nutrition
^ Dept. of Food Science

This study has been approved by the Department of Human Nutrition.

If you have any concerns about the ethical conduct of the research, you may contact the *University of Otago Human Ethics Committee* through the *Human Ethics Committee Administrator* (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated, and you will be informed of the outcome.



Supporting New Zealand Restaurants and Cafés to Reduce Food Waste

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. Personal identifying information (my name, my business name, contact details, audio-recordings) will be destroyed at the conclusion of the project, but my questionnaire answers, on which the results of the project depend, will be retained in secure storage for at least five years;
4. I will be asked pre-approved questions about my café/restaurant's food waste and what we're doing about it. During a telephone call, the student researcher may ask some questions that have not been determined in advance. If I feel hesitant or uncomfortable, I may decline to answer any question and/or may withdraw from the project without any disadvantage of any kind.
5. This research is funded by the University of Otago's Dept. of Human Nutrition.
6. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand). Every attempt will be made to preserve my anonymity.

I agree to take part in this project.

.....
Signature of participant

.....
Date

.....
Printed Name

.....
Company Name



Supporting New Zealand Restaurants and Cafés to Reduce Food Waste
INFORMATION SHEET FOR PARTICIPANTS

Thank you for completing Part 1 (questionnaire) and showing interest in Part 2 (audit). Please read this information before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

Project Aim and Purpose

Reducing food waste can save businesses money and help the planet, so we want to work with ~30 New Zealand cafés and restaurants to observe, categorise and quantify their food waste over a 24-hour period.

This audit will enable Sarah Chisnall and Emily Jones to complete their Master of Dietetics degree.

Participant expectations

Your café/restaurant has been selected for audit based on Part 1 results (location, type of business, high/medium/low food waste). If you choose to take part, staff will be instructed to separate all food waste produced over a 24-hour period into one of three category bins: consumer plate waste, preparation waste, or spoilage. Prior to the audit, a student researcher will visit to provide bins and instructions and answer questions (up to 1hr). At the end of the 24-hour period, the researcher will return to find out how the process went and conduct the waste audit (2-5hr). You can choose to answer researcher question(s) or not.

All information collected during this project will be treated *confidentially*. Only the people listed below will have access to your information. Please let us know if you want a copy of your results. After the project, identifying information will be destroyed. Dr Mainvil and Dr Miroso will safely store your information at the University of Otago for at least 5 years. Project results will be published and made available from the University of Otago Library; every attempt will be made to preserve your business's *anonymity*.

Can participants change their mind and withdraw from the project?

Taking part in this activity is voluntary. You may withdraw at any time with no disadvantage.

If you have any questions about our project, either now or in the future, please feel free to contact either:

- Sarah Chisnall* (Email: chisa097@student.otago.ac.nz)
- Emily Jones* (Email: jonem185@student.otago.ac.nz)
- Dr. Miranda Miroso^ (Email: miranda.miroso@otago.ac.nz) * Dept. of Human Nutrition
- Dr. Louise Mainvil* (Email: louise.mainvil@otago.ac.nz) ^ Dept. of Food Science

This study has been approved by the Department of Human Nutrition.

If you have any concerns about the ethical conduct of the research, you may contact the *University of Otago Human Ethics Committee* through the *Human Ethics Committee Administrator* (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated, and you will be informed of the outcome.



Supporting New Zealand Restaurants and Cafés to Reduce Food Waste

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. Personal identifying information (my name, my business's name, etc.) will be destroyed at the conclusion of the project, but our audit result, on which the results of the project depend, will be retained in secure storage for at least five years;
4. If I feel hesitant or uncomfortable about any question I am asked, I may decline to answer any question and/or may withdraw from the project without any disadvantage of any kind.
5. This research is funded by the University of Otago's Dept. of Human Nutrition.
6. The results of the project may be published and will be available in the University of Otago Library (Dunedin, New Zealand). Every attempt will be made to preserve my anonymity.

I agree to take part in this project.

.....
Signature of participant

.....
Date

.....
Printed Name

.....
Company Name

Appendix C: Research Protocol Documents

Part One: Self-Reported Questionnaire Research Protocol

Research Design Part I: Questionnaire Protocol

The questionnaire protocol will employ a mixed-method design to obtain self-reported data relating to information specific to each restaurant/café business, current waste practices, perceptions of strategies and motivations for reducing business generated food waste and whether each business would be willing to participate in an on-site food waste audit if selected.

- The New Zealand on-line regional Yellow Pages business listings for *Café* and *Restaurant* will be used to define and generate the pool of potential businesses eligible to be invited to take part in this research.
- The Statistics New Zealand *Industry Profiler* 2015 data detailing the number of Food and Beverage Services Businesses (FBSB's) by region (in the category 'one to 19 employees) will be used to determine approximate weightings for each region within our questionnaire sample size, to more accurately represent the assumed national distribution of Restaurant/Café businesses.
- Two separate questionnaire sample groups will be selected. One questionnaire sample will consist of businesses randomly selected from the Northland, Auckland and Waikato regions combined. This grouping accounts for approximately 50 percent of all FBSB's in New Zealand. The second questionnaire sample will consist of businesses randomly selected from all other regions in New Zealand combined. This accounts for the remaining approximately 50 percent of FBSB's in New Zealand.
- Each randomly selected questionnaire sample group will be weighted accordingly to reflect the number of businesses in each region in relation to the national total. Advice from a Biostatistician will be engaged as to the best method to undertake this process.
- A sample size of 150 businesses is desired for each questionnaire group, with a student researcher to take responsibility for one group each (Emily Jones - Upper North Island; Sarah Chisnall - Rest of New Zealand). A randomly selected list of businesses will be generated to ensure that this figure can be obtained accounting for the possibility of low response rates for participation.
- The first approach to a business will be verbally via telephone to establish:
 - (i) appropriateness of business to participate,
 - (ii) the correct person from the business to be talking to,

(iii) their willingness to participate in this food waste questionnaire. All businesses will have the right to decline to participate.

- Businesses can choose to either:
 - (i) undertake the questionnaire verbally at that current time,
 - (ii) undertake the questionnaire verbally at a nominated time suitable to the business,
 - (iii) be sent an electronic version of the questionnaire which they can complete at a time suitable to the business and return within an agreed timeframe.
- Informed consent will be obtained from each business willing to participate via verbal means (emailed consent form to be completed), as well as electronic provision (email) of information regarding ethics approval for the project.
- The questionnaire design will be based on a UK template, adapted for use within the contexts of New Zealand and the scope of this research project. It will take approximately 30 minutes to administer.
- One introductory explanation blurb will be finalised for both student researchers to use when contacting each business to ensure consistency within and between each questionnaire sample group.
- The questionnaire design will elicit self-reported data from each business to obtain both quantitative data (e.g. food waste weights, food waste categories, daily covers) and qualitative data (e.g. perceptions of impact and feasibility for potential strategies, motivations to reduce food waste).

Data Handling:

- Questionnaire data obtained will be analysed to create a detailed profile of current restaurant/café food waste in New Zealand.
- The questionnaire will not identify participating businesses specifically, and will use unique identification numbers. Data obtained regarding the participating business' contact number and staff name (person completing the questionnaire) will not be shared with anyone beyond the current research project team members.
- The data/information collected will be securely stored in such a way that only the researchers (Dr. Miranda Miroso, Louise Mainvil, Sarah Chisnall, Emily Jones) will be able to gain access to it. Specifically, it will be kept in a locked filing cabinet in Dr Miranda Miroso's office at the University of Otago.
- At the end of the research project, any personal information relating to individual businesses will be destroyed immediately except that, as required by the University of Otago's research policy, any raw data on which the results of

the project depend will be retained in secure storage by the Department of Food Science for five years, after which it will be destroyed.

Research Design Part II: Waste Audit Protocol

The waste audit protocol will employ a mixed methods design based on a UK template (WRAP UK) to obtain observational, self-reported and researcher-obtained data relating to the on-site food waste generated at each participating restaurant/café business.

Participant Recruitment:

- An on-site waste audit sample group will be obtained by selecting 15 businesses from those who completed the Part I Questionnaire and indicated their willingness to participate in an on-site waste audit.
- A convenience sampling technique will be employed to select 15 businesses due to the logistical and financial limitations of this research project. Although attempts will be made to include a range of restaurants/café where possible (e.g. high, medium and low food wasters based on questionnaire data, rural and urban, geographical location within each sample group (Upper North Island - Emily Jones; Rest of New Zealand - Sarah Chisnall)), it may be necessary to recruit any business willing to participate to achieve the desired waste audit sample size.

Format of On-site Waste Audit:

Day One:

- The auditor (student researcher) will visit the business at a designated time deemed appropriate by the business (ideally close to daily opening time), and obtain informed consent from the business to have their food waste analysed. This first visit will take approximately *one hour* to conduct.
- During this first visit, the auditor will set up a food waste segregation system that will be comprised of three separate bins (lined with black plastic bin liners of pre-recorded weight), each specifically allocated to be solely for either spoilage waste, preparation waste or consumer plate waste, to be left in place for a specified 24-hour period.
- The auditor will also provide waste definitions and sorting instructions for staff/employees who will be on-site working at the business throughout the day. Emphasis will be placed on instructing staff to refrain from using any other disposal routes for any food waste generated for the duration of the following 24-hour period.
- The auditor may attempt to gain a snapshot of the business' food waste generation through observation and speaking with staff if appropriate to do so.

Day Two:

- The auditor will revisit the business at approximately the same time as the day prior. This means a consistent 24-timeframe is used for each waste audit to ensure increased accuracy regarding analysis and comparison of food waste data between and within each sample size group. This second visit will take approximately *two to five hours* to complete.
- Upon arrival, the auditor will transfer the three separate food waste bins to a suitable space to begin sorting and auditing food waste. This may be off-site depending on the space available and the preference of the business being audited as to whether auditing on-site will interrupt the business operation.
- The auditor will remove the bin liner from each bin one at a time for auditing. Each bag will be weighed first (minus bag weight) to determine the total weight of each food waste type generated during the 24-hour period.
- The food waste in each bin liner will then be sorted separately into plastic containers (weight known) labelled by 13 defined food categories based on the WRAP UK protocol (see food category list below). Each container will be weighed (minus container weight) to determine how much food waste is generated by food category per type of food waste (e.g. amount of vegetable waste within total spoilage waste).
- The auditor will further separate each food category container into avoidable, potentially avoidable or unavoidable food waste, and determine the weight for each.
- This step-wise auditing process will be repeated separately for each bin liner containing the three types of food waste (spoilage waste, preparation waste, consumer plate waste).
- The auditor will attempt to clarify with staff/business contact if any queries arise regarding food waste that may have been incorrectly placed in the wrong bin during the 24-hour collection period.
- The auditor will be working to obtain the following information from each business by the conclusion of the on-site waste audit:
 - The weight of food waste generated for each of spoilage waste, preparation waste and consumer plate waste.
 - The weight of food waste generated by food category within the three types of food waste.
 - The weight of avoidable, potentially avoidable and unavoidable food waste generated by food category within each type of food waste.
 - Additional observations and participant perceptions and issues as appropriate.

- The auditor will deal with *mixed plate waste* by identifying the most dominant food type visible (e.g. spaghetti bolognese remnants determined as either meat or pasta based on which is most visually dominant). Food waste too mixed for visual identification will be allocated as *Unidentifiable Food Waste*. Only packaged liquid food waste will be included within the scope of this audit due to measuring difficulties associated with quantifying unpackaged liquid food waste.
- At the completion of the waste audit, all food waste will be replaced back into bin liners and disposed of as per normal practice on-site by the business.
- Proposed food categories for determining food waste composition:
 - Fruit - all types including inedible parts
 - Vegetables - all types including inedible parts
 - Potatoes - all types and forms (chips/fries/skin/whole/mashed)
 - Meat - all types and forms including inedible parts (bones/skin)
 - Fish - all types and forms including inedible parts (bones/skin/guts)
 - Dairy - all types including dairy alternatives (e.g. almond milk, soy cheese)
 - Eggs - including inedible parts (eggshells)
 - Bakery - includes all types of bread, pastry, muffins, scones, rolls
 - Cereals & Grains - including rice, pasta, couscous, other grains
 - Legumes, Nuts & Seeds - including lentils, pulses, beans, quinoa, nuts, seeds
 - Packaged Liquids – any not already included in another category (e.g. liquid oils, soups, beverages. Excludes milk).
 - Miscellaneous - any food waste that does not fit into any of the defined food categories (lollies, condiments, herbs & spices, coffee grounds, tea bags)
 - Unidentifiable Food Waste - any visually unidentifiable food waste unable to be allocated to a food category.

Waste Audit Data Handling:

- The data/information collected will be securely stored in such a way that only the researchers (Dr. Miranda Miroso, Louise Mainvil, Sarah Chisnall, Emily Jones) will be able to gain access to it. Specifically, it will be kept in a locked filing cabinet in Dr Miranda Miroso's office at the University of Otago.
- Data and information collected will not be shared with anyone outside of the research project team in such a way that would allow the identification of any participating business.
- At the end of the project, any personal information will be destroyed immediately except that, as required by the University's research policy, any

raw data on which the results of the project depend will be retained in secure storage by the Department of Food Science for five years, after which it will be destroyed.

Appendix D: Self-Reported Questionnaire Hardcopy Version

New Zealand Café & Restaurant Food Waste Questionnaire (University of Otago)

INFORMATION FOR PARTICIPANTS:

Thank you for your interest in this project. Please read this information before deciding whether or not to participate. If you decide to participate, we thank you. If you decide not to take part, there will be no disadvantage to you and we thank you for considering our request.

Project Aim and Purpose

Reducing food waste can save businesses money and help the planet, so we want to find out: The level and types of food waste from ~200 restaurants and/or cafés throughout New Zealand, and learn what businesses are doing to limit food spoilage, preparation waste, and consumer plate waste.

This project will enable Sarah Chisnall and Emily Jones to complete their Master of Dietetics degree.

Participant Expectations

We are asking New Zealand businesses, who are listed as a 'Café' or 'Restaurant' in the Yellow Pages, to answer ~20 questions over the phone, or via an online questionnaire, taking no more than 20-30 minutes.

The Dept. of Human Nutrition, who is funding this research, has approved the main questions (e.g. estimate the amount and type of food waste in your café/restaurant, your thoughts about it, what your business is doing to reduce it), but some new questions may arise. You can choose to answer a question or not (select/type I'm not willing to answer or N/A where appropriate).

All information collected during this project will be treated confidentially. Only the people listed below will have access to your responses. After the project, identifying information will be destroyed. Dr Mainvil and Dr Miroso will safely store your information at the University of Otago for at least 5 years. Project results will be published and made available from the University of Otago Library or us; every attempt will be made to preserve your anonymity (for you and your business) in any publications.

Can participants change their mind and withdraw from the project?

Taking part in this activity is voluntary. You may withdraw at any time with no disadvantage.

If you have any questions about our project, either now or in the future, please feel free to contact either:

Sarah Chisnall (Email: chisa097@student.otago.ac.nz) - Dept. of Human Nutrition
Emily Jones (Email: jonem185@student.otago.ac.nz) - Dept. of Human Nutrition
Dr Miranda Miroso (Email: miranda.miroso@otago.ac.nz) - Dept. of Food Science
Dr Louise Mainvil (Email: louise.mainvil@otago.ac.nz) - Dept. of Human Nutrition

This study has been approved by the Department of Human Nutrition.

If you have any concerns about the ethical conduct of the research, you may contact the University of Otago Human Ethics Committee through the Human Ethics Committee Administrator (ph. 03 479-8256). Any issues you raise will be treated in confidence and investigated, and you will be informed of the outcome.

PARTICIPANT CONSENT:

I have read the above information concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. Personal identifying information (my name, my business name, contact details, audio-recordings) will be destroyed at the conclusion of the project, but my questionnaire answers, on which the results of this project depend, will be retained in secure storage for at least five years;
4. I will be asked pre-approved questions about my café/restaurant's food waste and what we're doing about it. If I feel hesitant or uncomfortable, I may withdraw from the project without any disadvantage of any kind.
5. This research is funded by the University of Otago's Dept. of Human Nutrition.
6. The results of this project may be published and will be available in the University of Otago Library (Dunedin, New Zealand). Every attempt will be made to preserve my anonymity.

I agree to take part in this project by ticking the box below.

I consent to take part in this project

Signature _____ Date _____

PART ONE:

The aim of this study is to assess the level and types of food waste generated by New Zealand restaurants and cafés, specifically looking at the areas of consumer plate waste, preparation waste, and spoilage waste.

Q1 Business Name

Q2 Business Address

Q3 Contact Name and Job Title -

Q4 Business Telephone

Q5 Self-reported classification of business

- Café
- Restaurant
- Café AND Restaurant
- Other _____

Q6 Do most of your customers consume food on your premises or take their food away?

- Eat their food on the premises
- Take their food away from the premises
- About equal amounts take food away as eat on the premises
- I'm not willing to answer

Q7 Which of the following types of food service does your business provide? (Select all that apply)

- Breakfast
- Morning break
- Lunch
- Afternoon break
- Dinner
- Snacks
- Take away
- No meals are provided
- I'm not willing to answer

Q8 Approximately how many covers does your business serve on a daily basis?

- 0-25
- 26-50
- 51-100
- 101-200
- 201-300
- More than 300
- I don't know
- I'm not willing to answer

Q9 What days of the week does your business trade?

Q10 How many weeks per year does your business trade?

Q11 Approximately how much TOTAL waste (rubbish) does your business produce each day (e.g. bags or bins)? (Please specify amount e.g. 1.5 x 60L bin or 1 x 240L bin).

Q12 Approximately how much TOTAL recycling does your business produce each day (e.g. bags or bins)? (Please specify amount e.g. 1 x 240L bin).

Q13 Does your business regularly sort out food waste for disposal separately from general waste?

- Yes
- No
- I'm not willing to answer

Q14 Do you monitor the amount of food waste your business produces? (e.g. waste audits/reviews)

- Yes
- No
- I'm not willing to answer

Q15 If yes, how does your business do this? If no, are there any particular reasons why not?

Q16 Approximately what percentage of your business' TOTAL waste would be food waste?

(By food waste we mean all edible and inedible food that is thrown out in your business, such as fruit and vegetable scraps, meat bones, partially used foods, foods that have passed their 'use by' date or 'best before' date, or food thrown away for other reasons).

- Less than 20% (less than one fifth or 1 of 5)
- 20 to 39% (one to two fifths or 1-2 of 5)
- 40 to 59% (two to three fifths or 2-3 of 5)
- 60-79% (three to four fifths or 3-4 of 5)
- 80% or more (more than four fifths or 4-5 of 5)
- I don't know
- I'm not willing to answer

Q17 Approximately what percentage of your business' total food waste would be considered avoidable food waste?

(By avoidable we mean any edible food that was intended for human consumption at some point before it was thrown away, even if it had become inedible at the time it was thrown away)

- Less than 20% (less than one fifth or 1 of 5)
- 20 to 39% (one to two fifths or 2 of 5)
- 40 to 59% (two to three fifths or 3 of 5)
- 60 to 79% (three to four fifths or 4 of 5)
- 80% or more (more than four fifths or 4-5 of 5)
- I don't know
- I'm not willing to answer

Q18 What proportion of your business' total FOOD waste is the result of:
(total must equal 100)

Food spoilage

(any food that has been discarded due to spillage, spoilage (e.g. mould), loss of quality, past product 'best before' or 'use by' date).

_____ %

Food preparation

(any food item discarded during meal preparation (e.g. vegetable peelings, bread crusts, bones) or incorrect cooking times and techniques)

_____ %

Consumer plate waste

(any food item that has been ordered by the customer but was left on the plate uneaten)

_____ %

I'm not willing to answer

Q19 What are the five most commonly wasted food items in your business for **Food spoilage**?

1st =

2nd =

3rd =

4th =

5th =

Q20 What are the five most commonly wasted food items in your business for **Food preparation**?

1st =

2nd =

3rd =

4th =

5th =

Q21 What are the five most commonly wasted food items in your business for **Consumer plate waste**?

1st =

2nd =

3rd =

4th =

5th =

Q22 How do you feel about the current amount of food waste produced by your business and why?

Q23 Do you have any policies and/or procedures in place to limit or reduce the food waste your business generates?

(e.g. reviewing food purchasing/supply/storage practices, altering menu choice/portions, staff training, consumer education, provision of 'doggy bags', donating to food banks or the homeless)

- Yes
- No
- Don't know / not sure

Q24 If yes, please specify what type of policies and/or procedures your business currently follows

Q25 How would you rate the following strategies as a way for your business to reduce food waste?

	How much impact would this strategy have on reducing your business' food waste?				How difficult or easy would it be for your business to implement this strategy?			
	Low	Medium	High	N/A	Difficult	Medium	Easy	N/A
Order products with a short shelf-life more frequently in smaller amounts.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Implement a First-In, First-Out system to ensure oldest stock and partially opened/used stock is always used first.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Offer a daily special based on what stock/product needs to be used quickly to prevent it from spoiling and being wasted.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use fresh fruit and vegetables without peeling or removing skins that are edible (e.g. carrot, apple, potato skins).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use bones and trimmings to make stocks, and fresh produce off-cuts such as cauliflower leaves and silver-beet stalks, to make sauces, pesto and salads.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Employ a Nose-to-Tail approach for meat products and/or a Fruit-to-Root approach from plant products to use less-desirable parts in menu dishes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	How much impact would this strategy have on reducing your business' food waste?				How difficult or easy would it be for your business to implement this strategy?			
	Low	Medium	High	N/A	Difficult	Medium	Easy	N/A
Develop standardised recipes for menu items to ensure correct cooking times and methods are followed to avoid over-or-under cooking products.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Provide customers with a choice for smaller or larger portions of individual meal items on the menu and the associated price.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Allow customers to swap meal items for an alternative they would prefer to eat.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Customers order meal items (that aren't the main feature of the meal) such as salad, rice and fries as a separate side dish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Serve smaller portions of side dishes with one free top up available upon customer request.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Offer an option for customers to take home left-overs (provision of a 'doggy bag').	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Donate food to food banks or the homeless.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q26 Comments/other strategies which could impact your business' food waste

Q27 Of the strategies listed above, which would be most effective in reducing your business' food waste and/or which would you be most willing to try?

Q28 What would motivate your business (you) to reduce food waste? How important are each of these outcomes to your business?

	Irrelevant	Not at all important	Somewhat important	Moderately important	Very important	Extremely important	I decline to answer
It is important that we save the planet (environmental outcomes)	<input type="checkbox"/>						
It is important that we save money (financial/economic outcomes)	<input type="checkbox"/>						
It is important that we save hungry people (social/humanitarian outcomes)	<input type="checkbox"/>						
It is important we reduce guilt (personal/internal outcomes)	<input type="checkbox"/>						

Q29 Other outcomes that are 'very important' to me are:

PART TWO:

In the second part of this project, we will be asking up to 30 cafés and restaurants to take part in an on-site food waste audit. This means staff would put food waste in one of three category bins over a 24-hour period and we would sort and measure it. In return, we would happily share our results with you. You're under no obligation to take up this offer.

Q30 Would your business be interested and willing to participate in a food waste audit?

- Yes - Great, thank you! We will contact you within a month if your business is selected for audit.
- No

Appendix E: 24-Hour Food Waste Audit Bin Labels

FOOD PREPARATION WASTE

Any food item discarded during meal preparation or incorrect cooking times and techniques e.g.

Vegetable peelings and trimmings

Bread crusts

Meat off-cuts, skin and bones

Burnt food items

Egg shells

Pastry off-cuts

FOOD SPOILAGE WASTE

Any food that has been discarded due to spillage, spoilage, loss of quality or past 'best before'/'use by' date e.g.

Mould growth

Sour ('off') milk/cream etc

Rotten/wilted green leafage

Spilt flour/sugar etc

Stale Eggs

Pesto/hummus past use by date

CUSTOMER PLATE WASTE

Any food item that has been ordered by the customer but was left on their plate uneaten e.g.

Sides of butter/spreads

Uneaten sandwich crusts/fillings

Muffin/scone remnants

Hot chips, bread/toast

Unused sauces/accompaniments

Garnishes, bones, skins

Appendix F: Food Waste Audit Data Recording Sheet

NEW ZEALAND CAFÉ & RESTAURANT ON-SITE FOOD WASTE AUDIT DATA					
Business Name:				Audit Date:	
Food Category	Total Weight	Avoidable Weight	Potentially Avoidable Weight	Unavoidable Weight	Additional Notes
SPOILAGE FOOD WASTE				TOTAL WEIGHT =	
Fruit					
Vegetables					
Potatoes					
Meat					
Fish					
Dairy					
Eggs					
Bakery					
Cereals & Grains					
Legumes, Nuts & Seeds					
Packaged Liquids					
Miscellaneous					
Unidentified Food Waste					
FOOD PREPARATION WASTE				TOTAL WEIGHT =	
Fruit					
Vegetables					
Potatoes					
Meat					
Fish					

Dairy					
Eggs					
Bakery					
Cereals & Grains					
Legumes, Nuts & Seeds					
Packaged Liquids					
Miscellaneous					
Unidentified Food Waste					
CUSTOMER PLATE WASTE				TOTAL WEIGHT =	
Fruit					
Vegetables					
Potatoes					
Meat					
Fish					
Dairy					
Eggs					
Bakery					
Cereals & Grains					
Legumes, Nuts & Seeds					
Packaged Liquids					
Miscellaneous					
Unidentified Food Waste					

Appendix G: Additional Food Waste Audit Images

Examples of Preparation Food Waste



Examples of Customer Plate Waste





Example of 'Unidentified Food Waste' Food Grouping for Customer Plate Waste

